

FIG. 1A

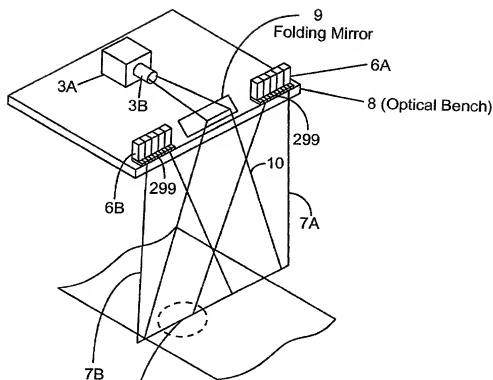


FIG. 1B1

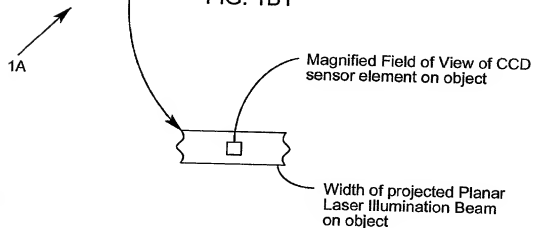


FIG. 1B3

- (1) Fixed Focal Length Camera Lens
(2) Fixed Focal Distance

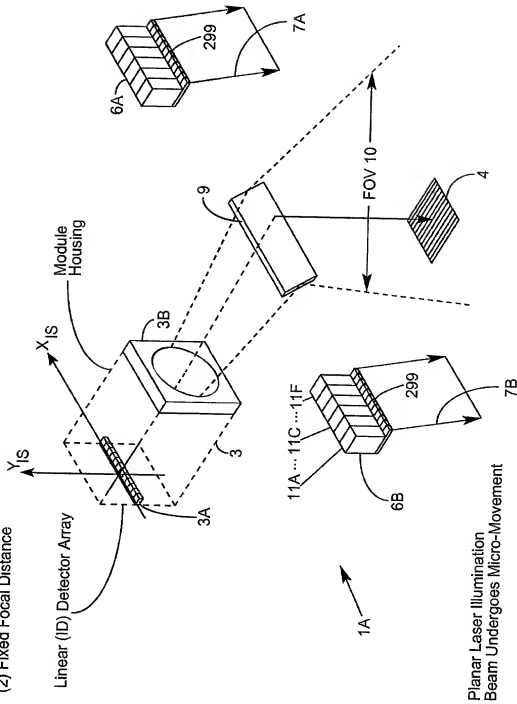


FIG. 1B2

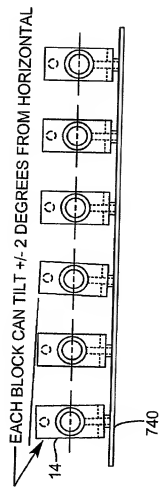


FIG. 1B4

VLD BLOCK CAN PITCH FORWARD FOR ALIGNMENT WITH OTHER VLD BEAMS

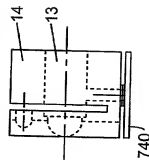
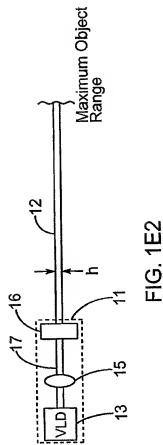
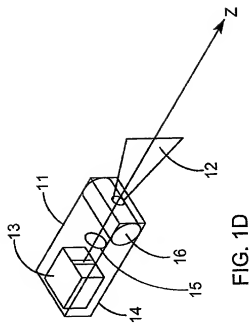
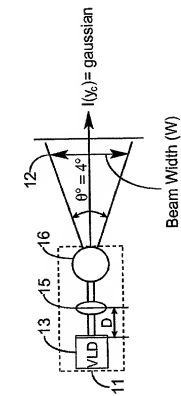
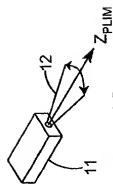


FIG. 1B5



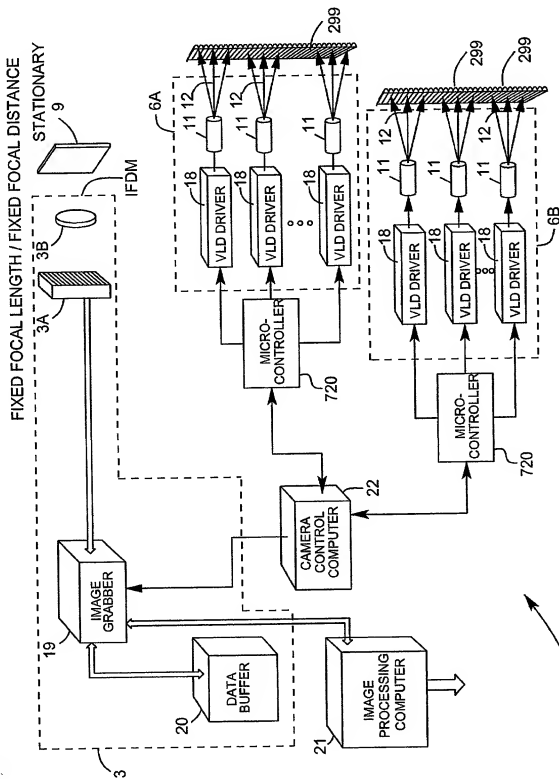


FIG. 1F

10091339.071202
202170.68216007

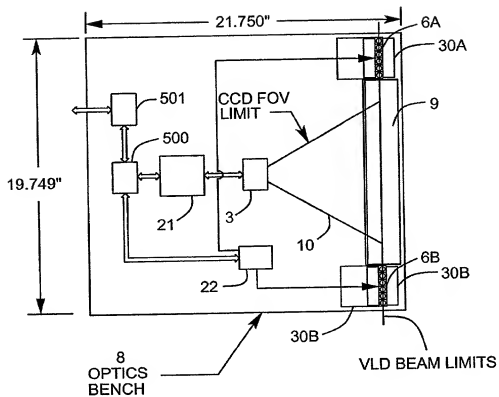


FIG. 1G2

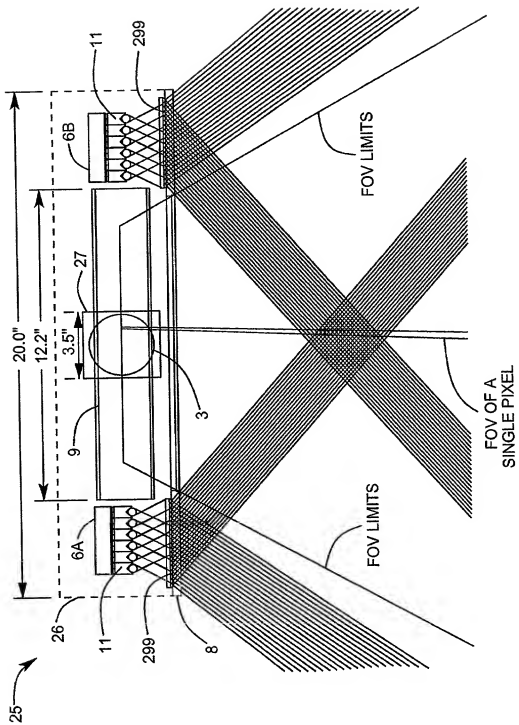


FIG. 1G3

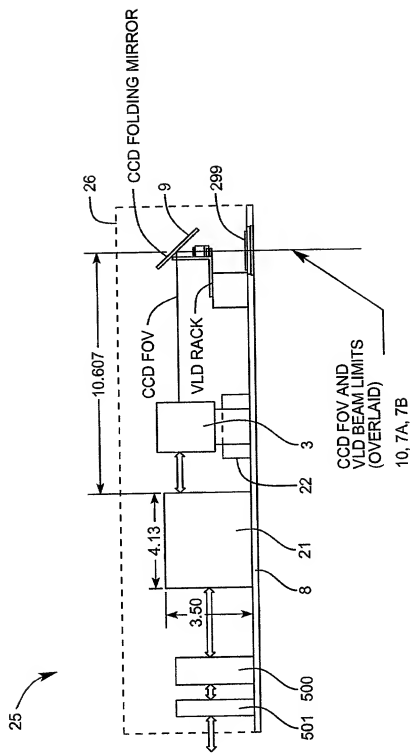


FIG. 1G4

202170-66T600T
10091339-071202

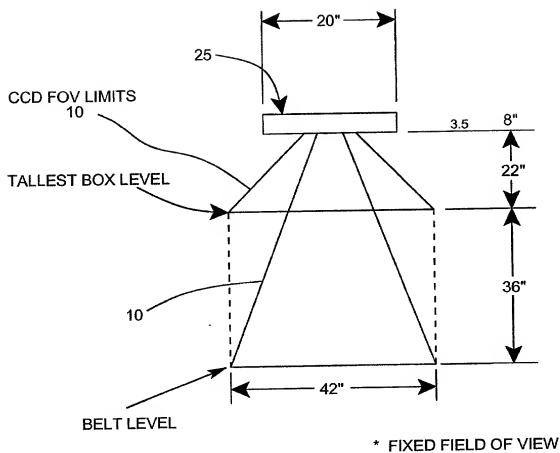


FIG. 1G5

10091339.071202

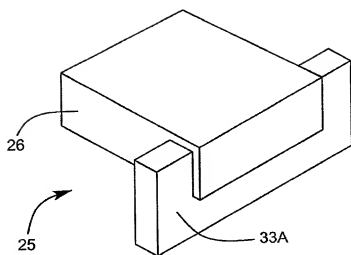


FIG. 1G6

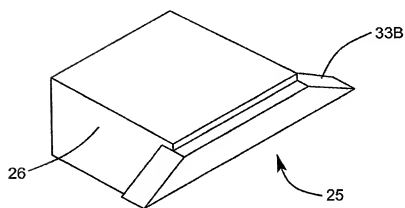


FIG. 1G7

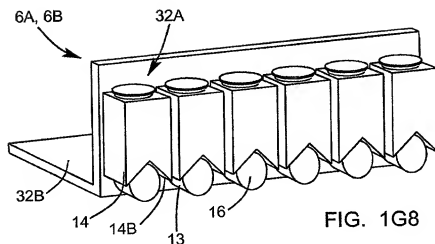


FIG. 1G8

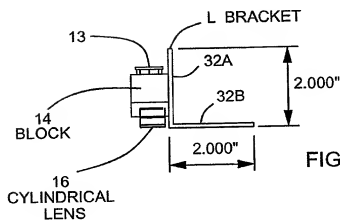


FIG. 1G9

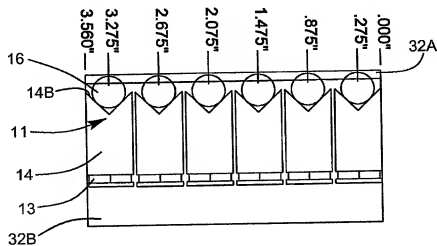


FIG. 1G10

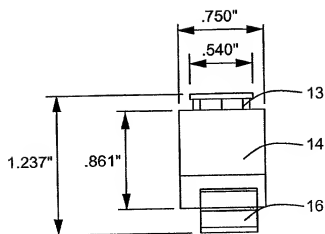


FIG. 1G11

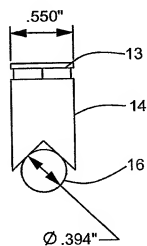


FIG. 1G12

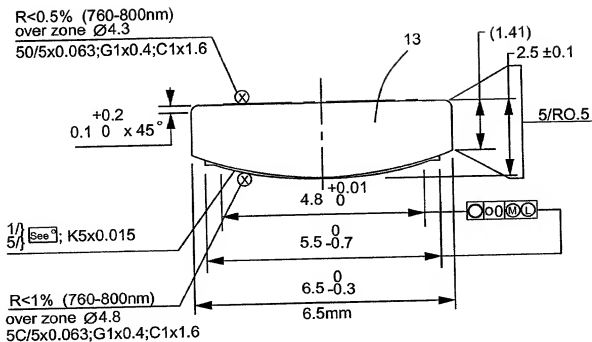


FIG. 1G13

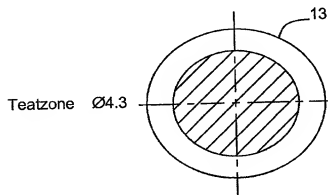


FIG. 1G14

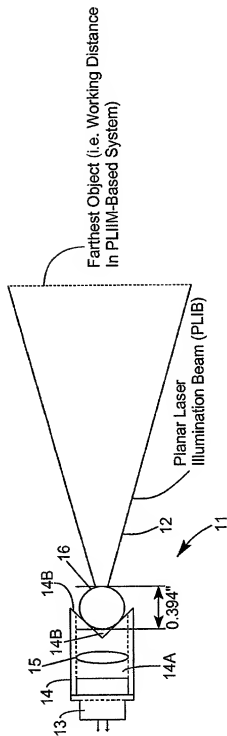


FIG. 1G15A

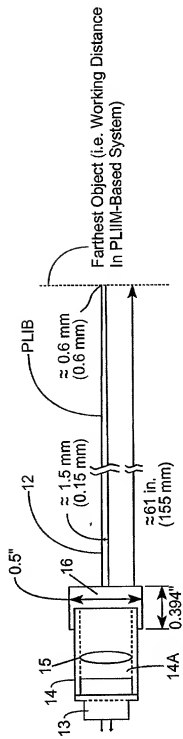


FIG. 1G15B

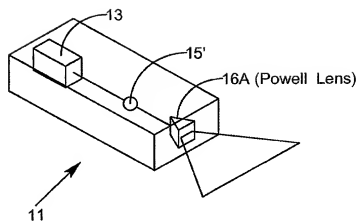


FIG. 1G16A

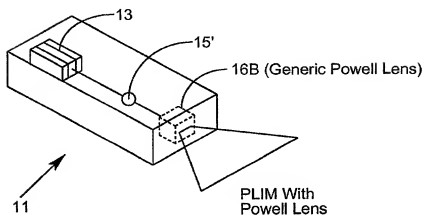


FIG. 1G16B

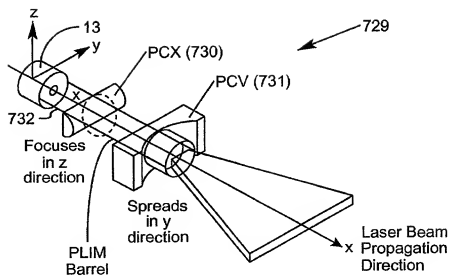


FIG. 1G17A

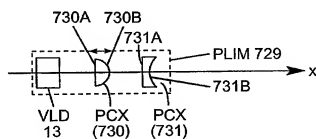


FIG. 1G17B

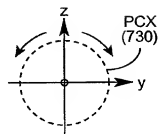


FIG. 1G17C

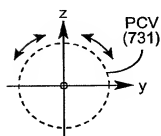


FIG. 1G17D

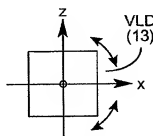


FIG. 1G17E

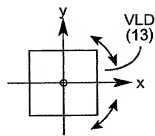


FIG. 1G17F

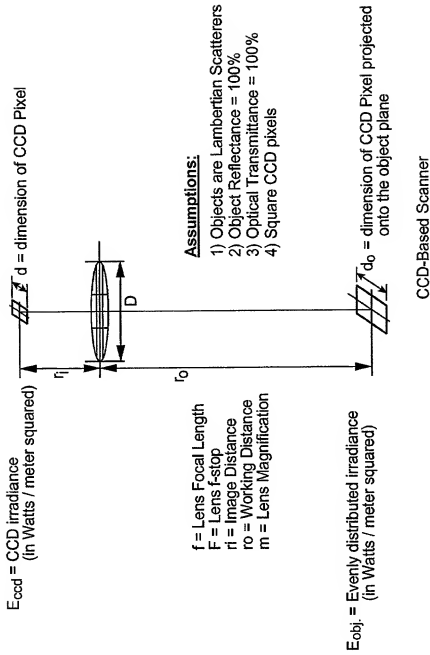


FIG. 1H6

FIRST GENERALIZED METHOD OF REDUCING
SPECKLE-NOISE PATTERNS AT IMAGE DETECTION
ARRAY OF THE IFD SUBSYSTEM (3)

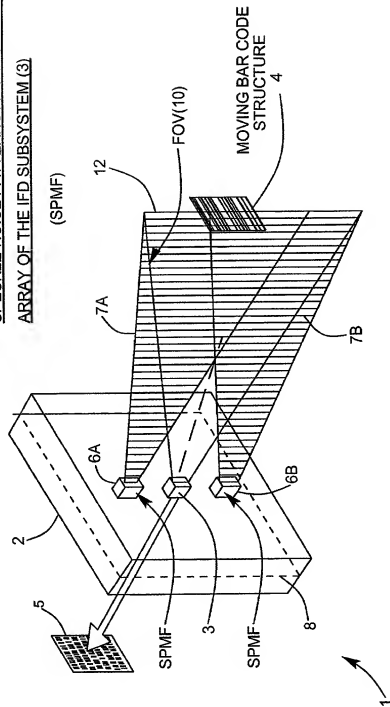


FIG. 111

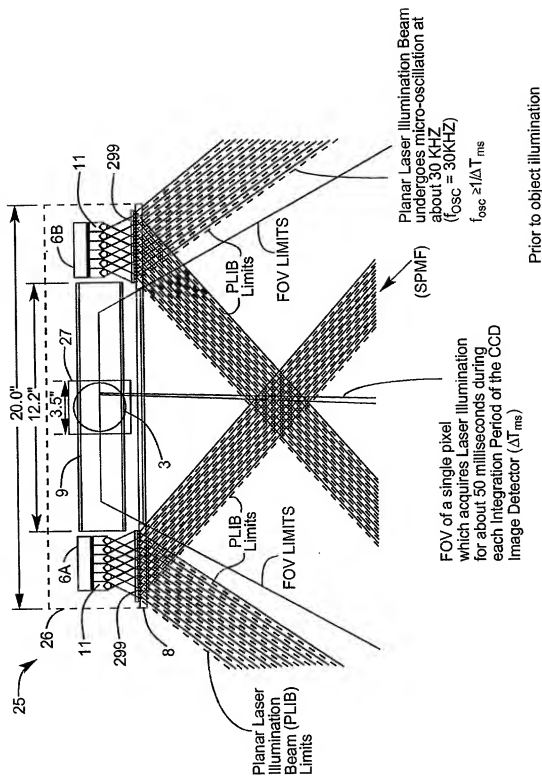


FIG. 112A

THE FIRST GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial phase of the transmitted PLIB along the planar extent thereof according to a spatial phase modulation function (SPMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

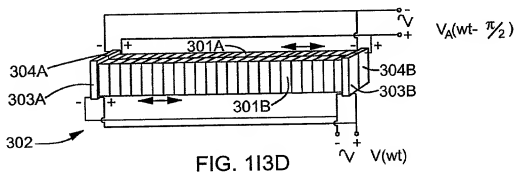
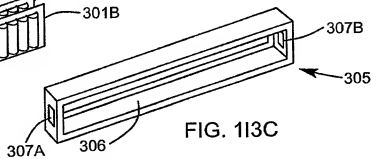
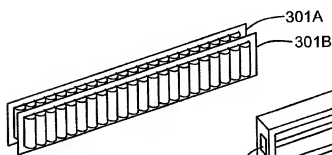
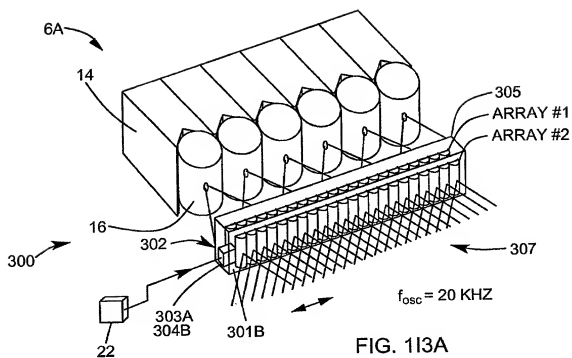
A

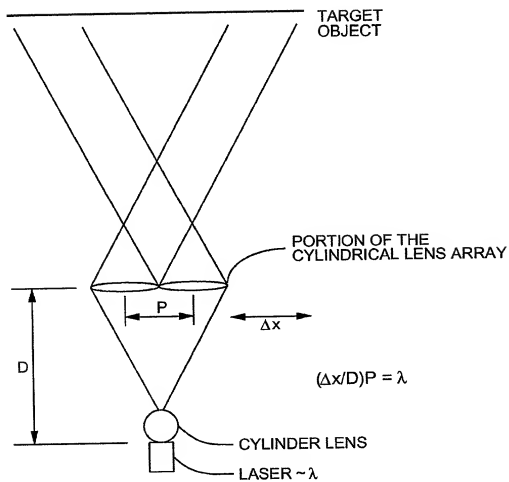
Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

B

FIG. 112B

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$$\Delta x \geq \frac{\lambda \cdot D}{P}$$

FIG. 113E

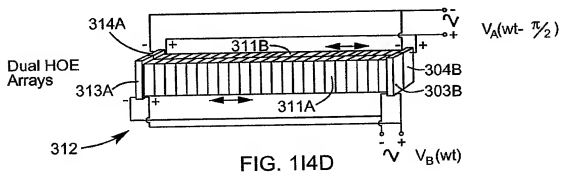
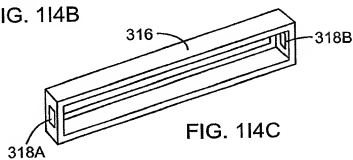
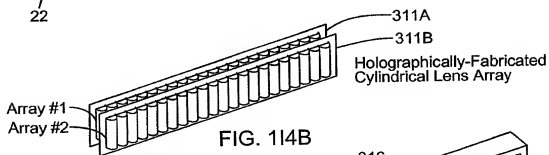
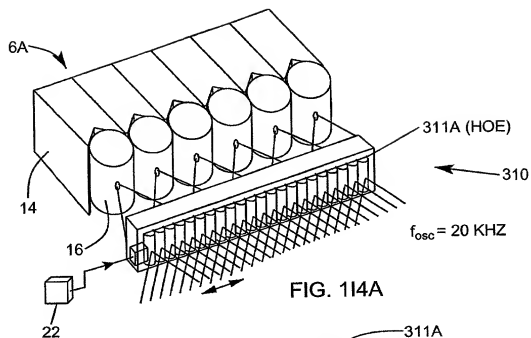
10091339-071202



FIG. 113F



FIG. 113G



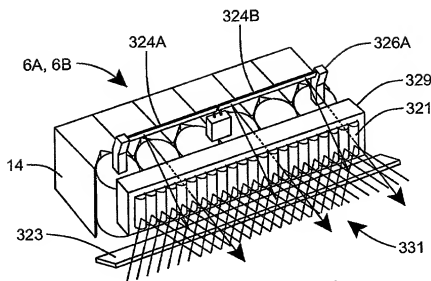


FIG. 115A

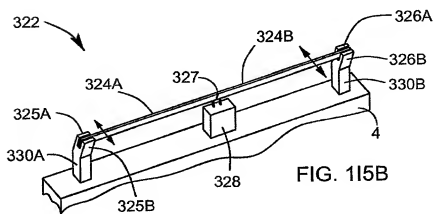


FIG. 115B

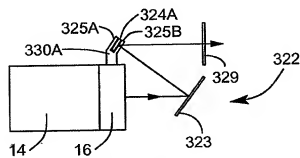


FIG. 115C

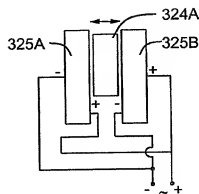


FIG. 115D

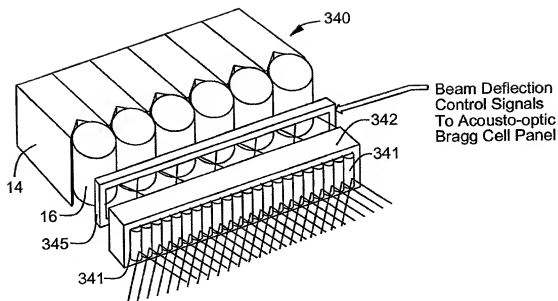


FIG. 116A

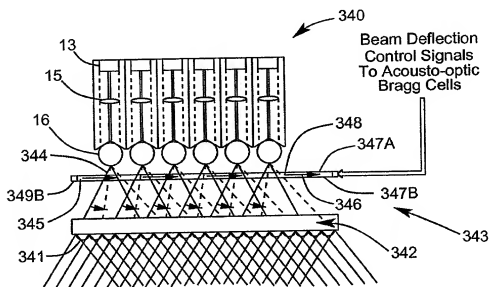
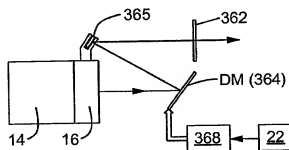
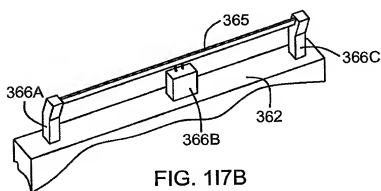
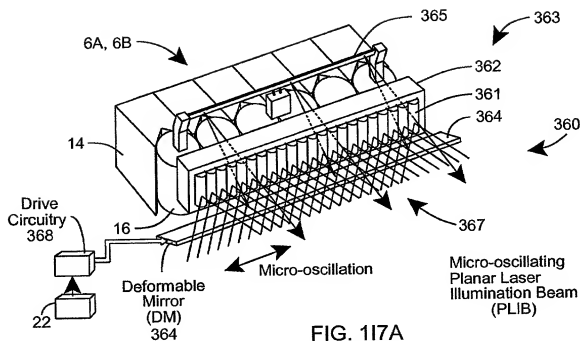
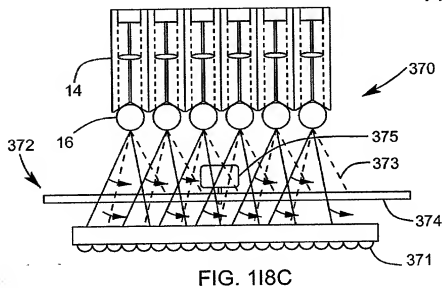
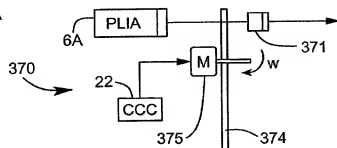
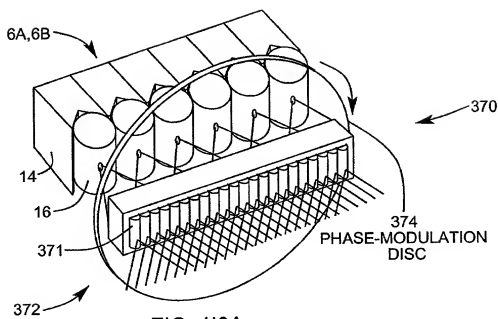


FIG. 116B





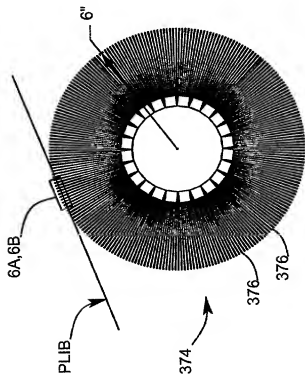


FIG. 118D

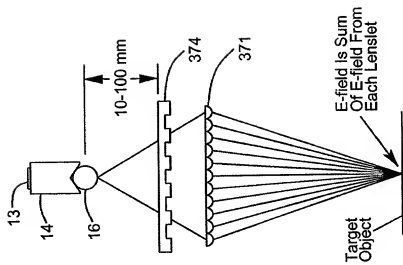


FIG. 118E

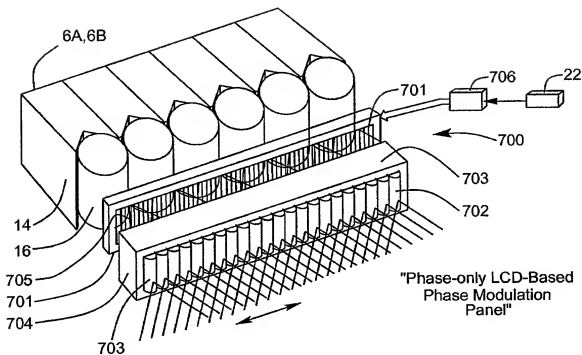


FIG. 118F

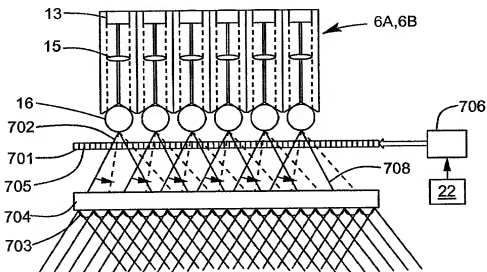


FIG. 118G

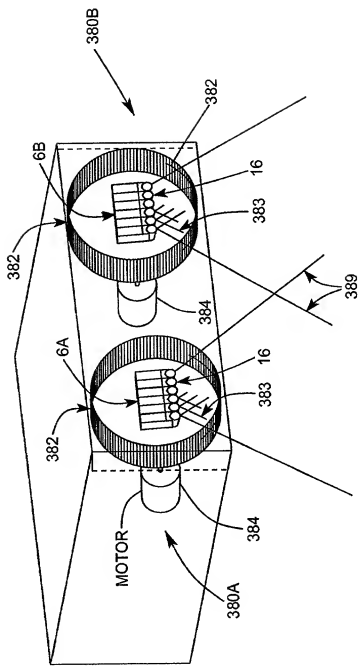
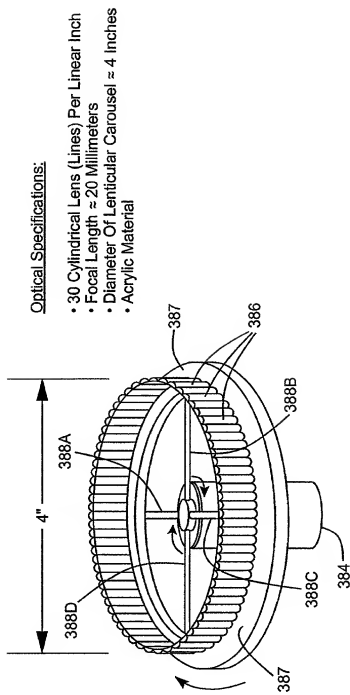


FIG. 119A



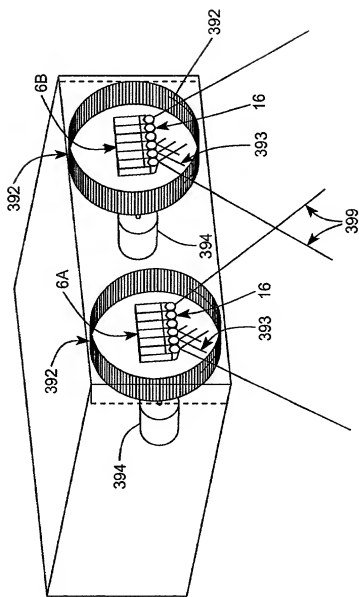


FIG. 1110A

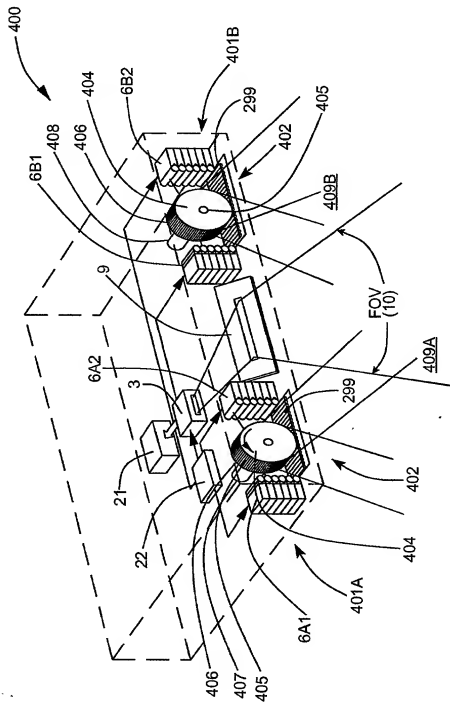


FIG. 1111A

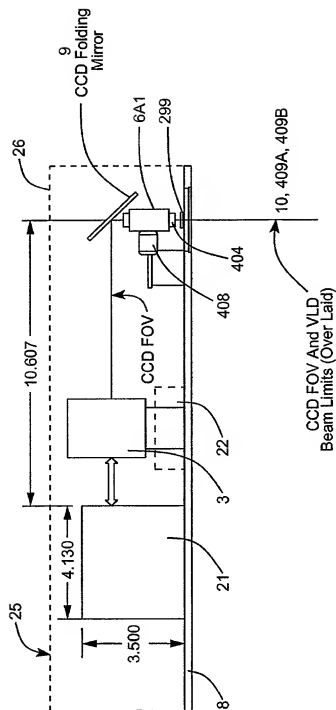


FIG. 111B

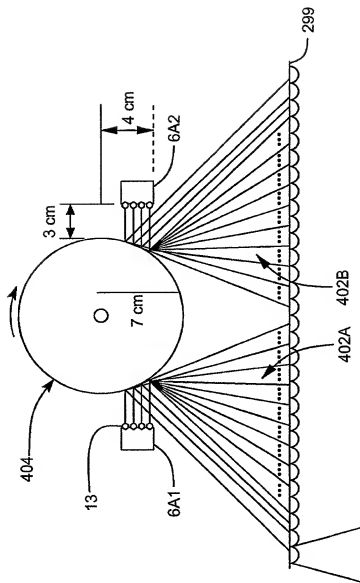


FIG. 1I11C

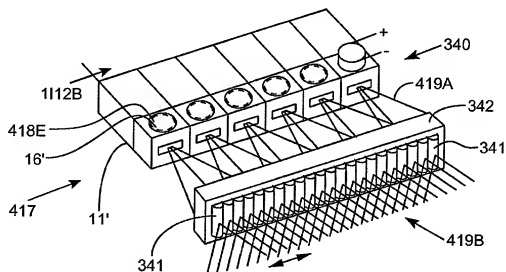


FIG. 11I2A

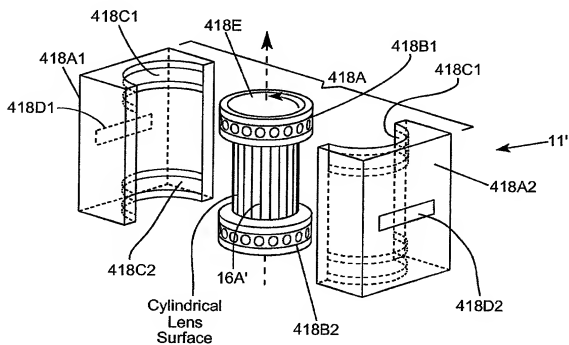


FIG. 11I2B

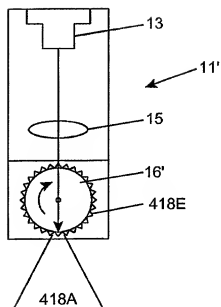


FIG. 1112C

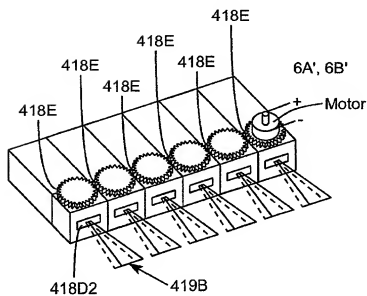


FIG. 1112D

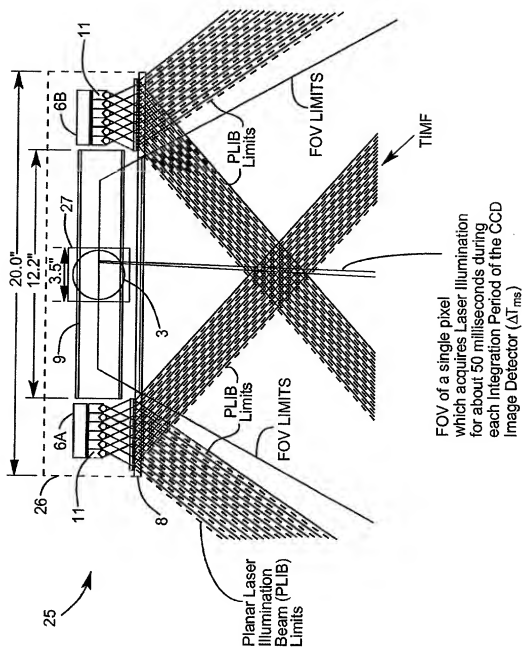


FIG. 1113A

THE SECOND GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

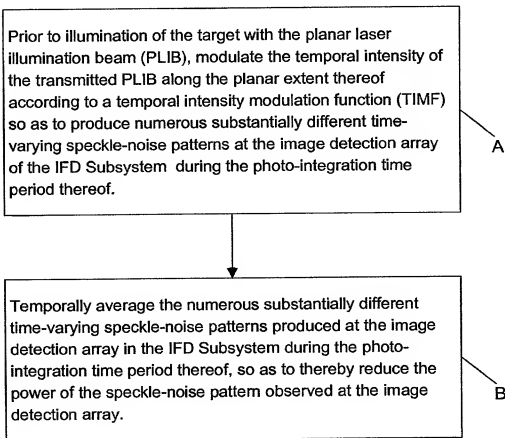
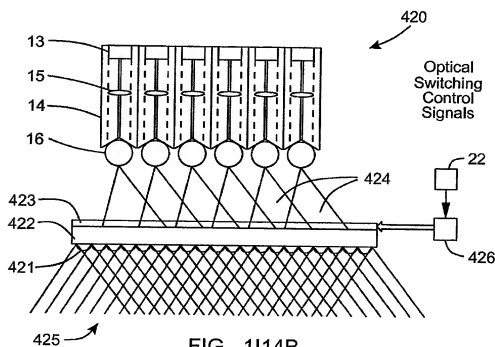
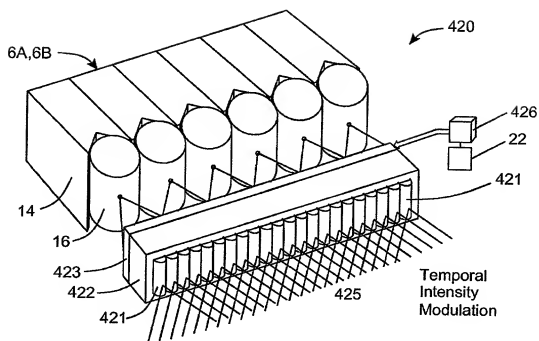
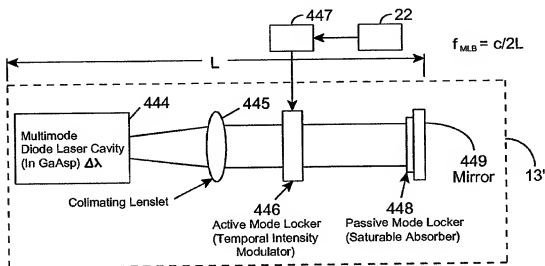
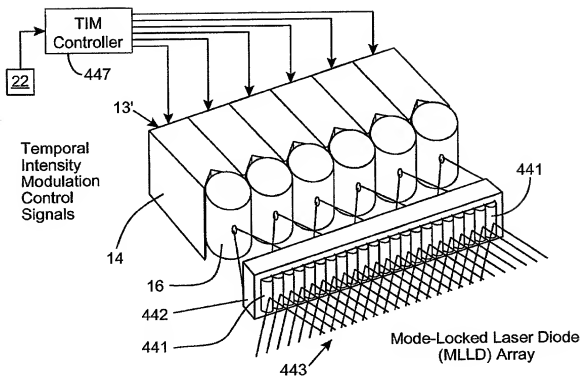


FIG. 1113B





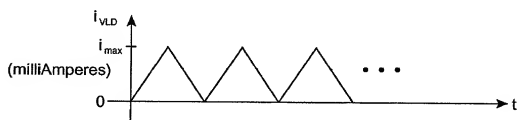


FIG. 1115E

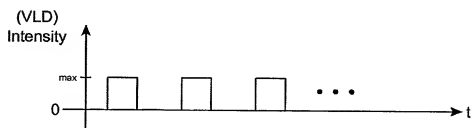


FIG. 1115F

Third Generalized Method Of
Reducing Speckle-Noise Patterns
At Image Detection Array
Of The IFD Subsystem (3)

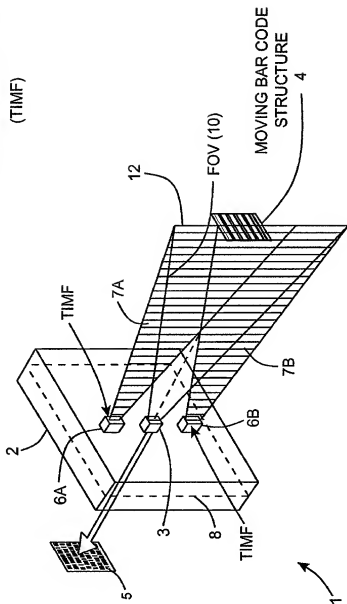


FIG. 1116

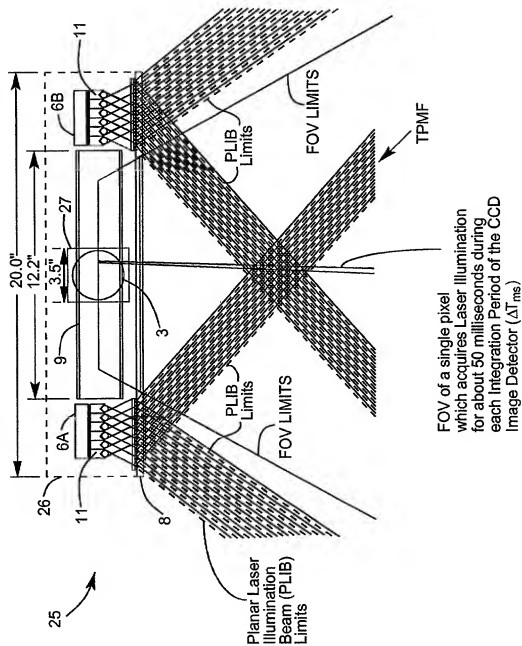


FIG. 1116A

THE THIRD GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

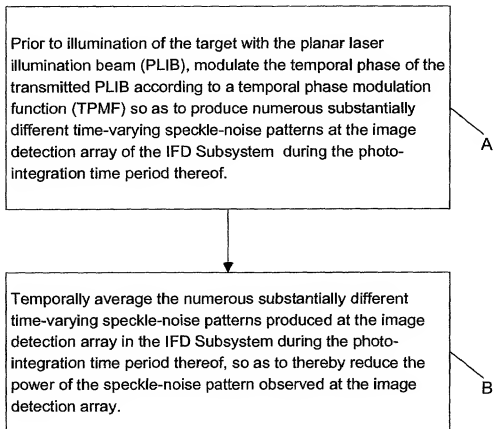


FIG. 1116B

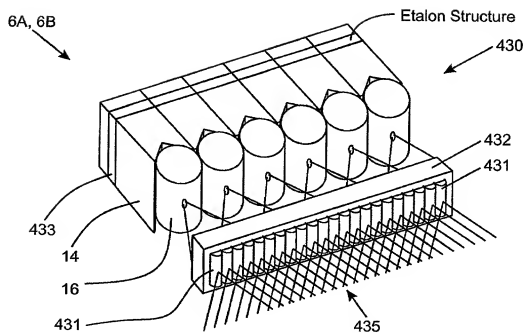


FIG. 1117A

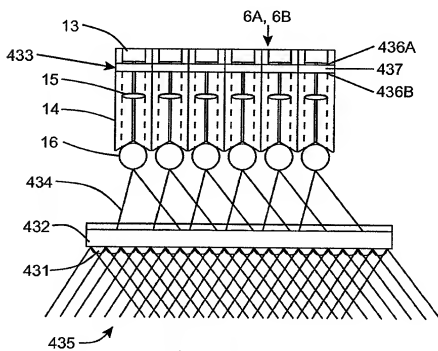


FIG. 1117B

Fourth Generalized Method Of
Reducing Speckle-Noise Patterns
At Image Detection Array
Of The IFD Subsystem (3)

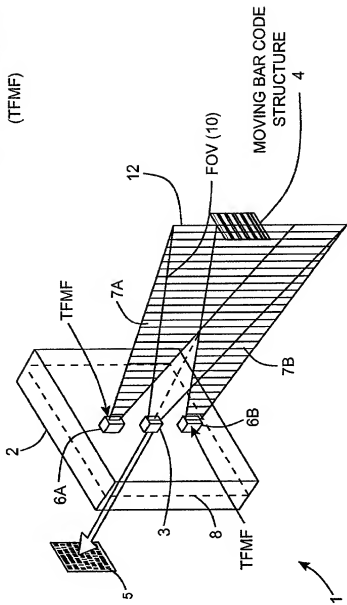


FIG. 1118

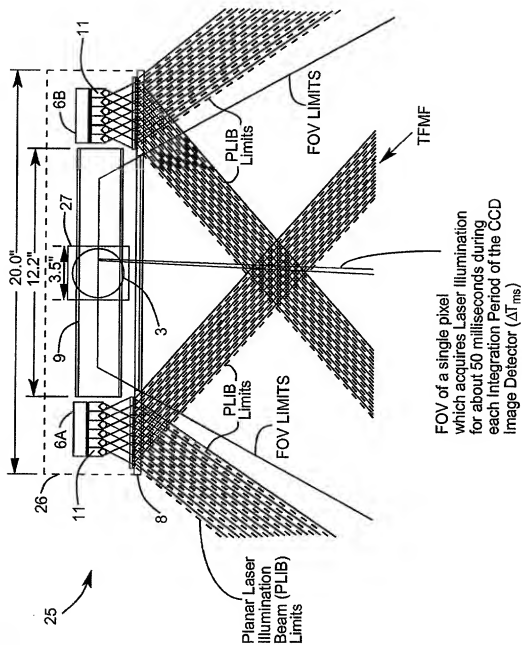


FIG. 1118A

THE FOURTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

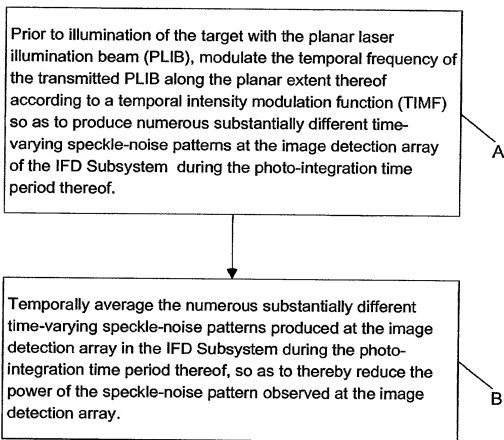
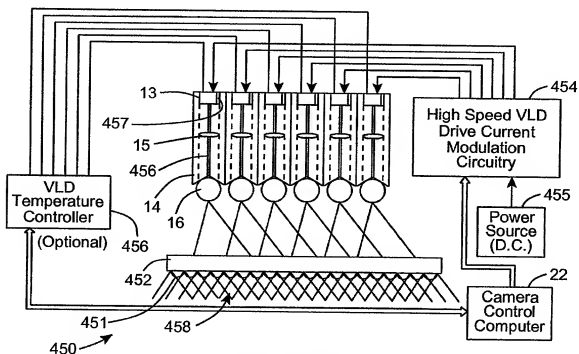
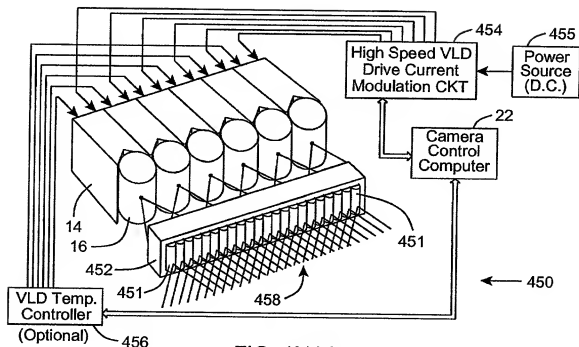


FIG. 1118B

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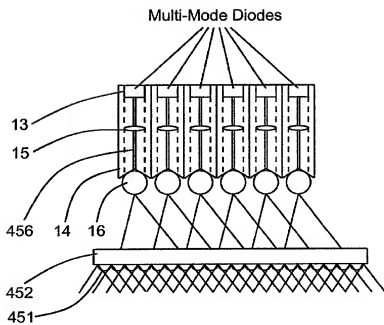


FIG. 1119C

Fifth Generalized Method Of
Reducing Speckle-Noise Patterns
At Image Detection Array
Of The IFD Subsystem (3)

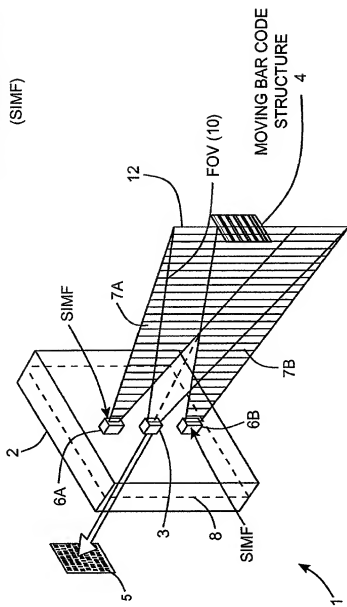


FIG. 1120

THE FIFTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the transmitted PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-Integration time period thereof.

A

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

B

FIG. 1120B

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Sixth Generalized Method Of
Reducing Speckle-Noise Patterns
At Image Detection Array
Of The IFD Subsystem (3)

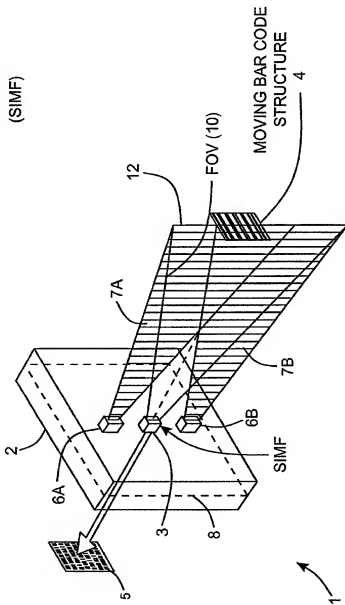


FIG. 1122

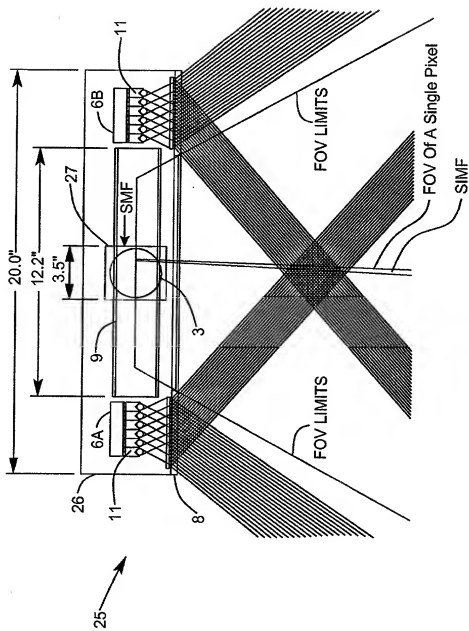


FIG. 1122A

THE SIXTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

After illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

A

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

B

FIG. 1122B

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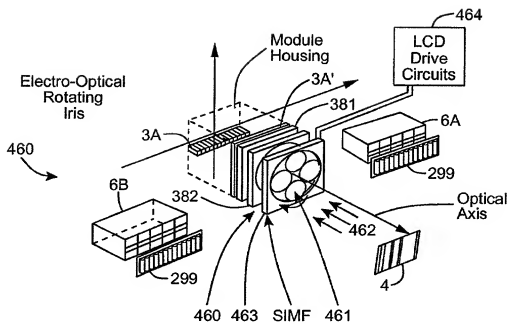


FIG. 1123A

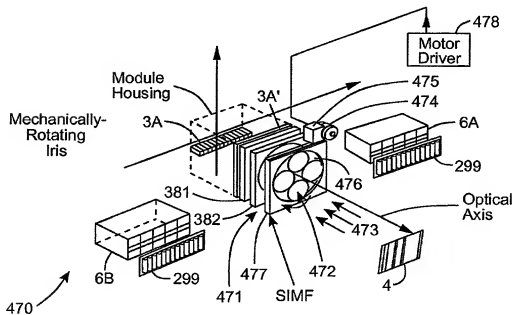


FIG. 1123B

Seventh Generalized Method Of
Reducing Speckle-Noise Patterns
At Image Deflection Array
Of The IFD Subsystem (3)

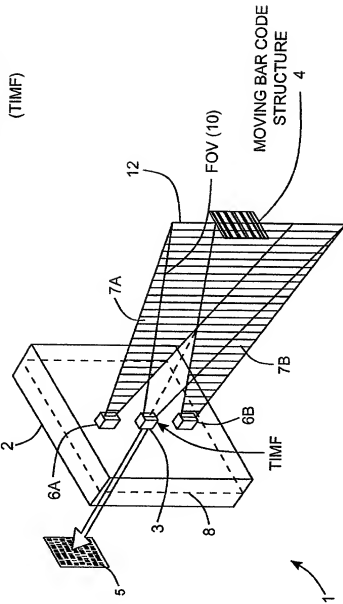


FIG. 1/24

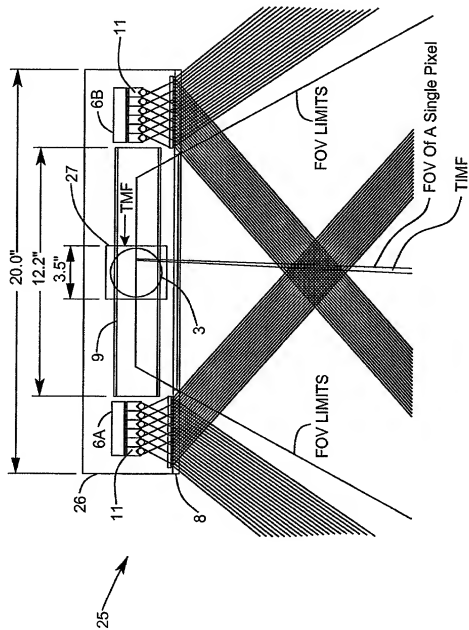


FIG. 1124A

THE SEVENTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

After illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to produce many substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

A

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

B

FIG. 1124B

THE EIGHT GENERALIZED SPECKLE-NOISE PATTERN REDUCTION
METHOD OF THE PRESENT INVENTION

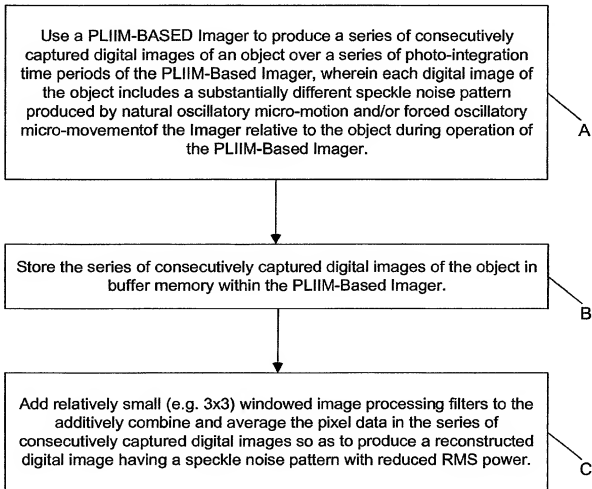


FIG. 1124D

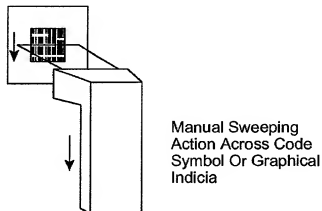
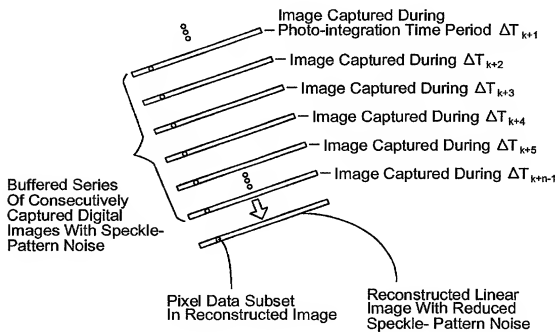


FIG. 1124E



Case: Linear Imager

FIG. 1124F

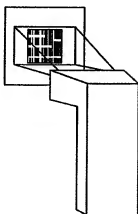
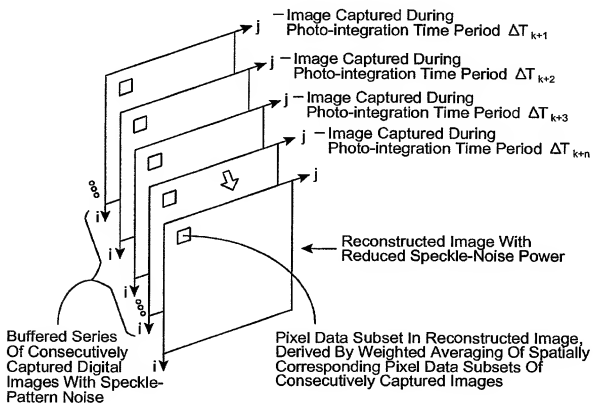


FIG. 1I24G



Case: 2D Area Imager

FIG. 1I24H

THE NINTH GENERALIZED METHOD OF REDUCING SPECKLE PATTERN
NOISE IN PLIIM-BASED IMAGING SYSTEMS

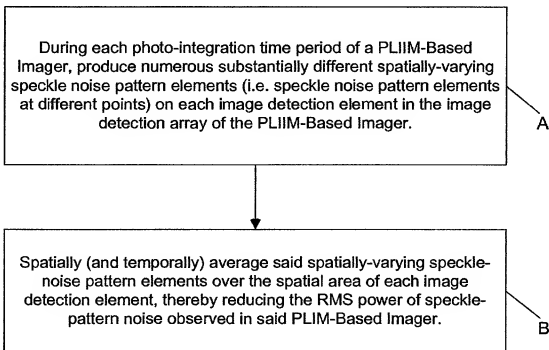


FIG. 1124I

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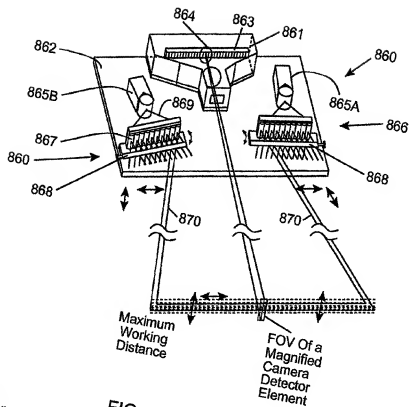


FIG. 1125A1

* Lateral And Transverse Micro-oscillation Of PLIB

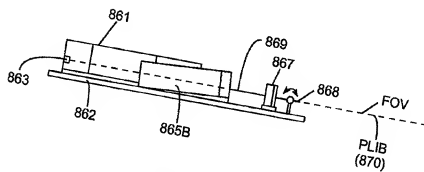
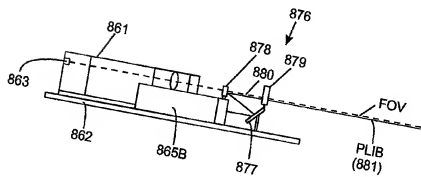
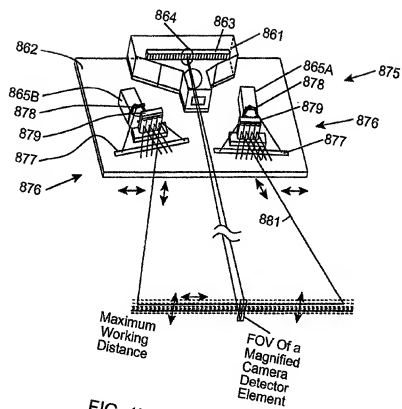
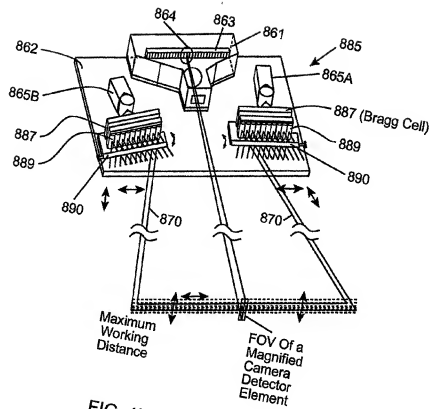
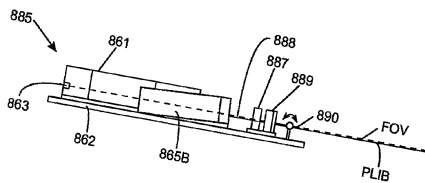


FIG. 1125A2





* Lateral And
Transverse
Micro-oscillation
Of PLIB



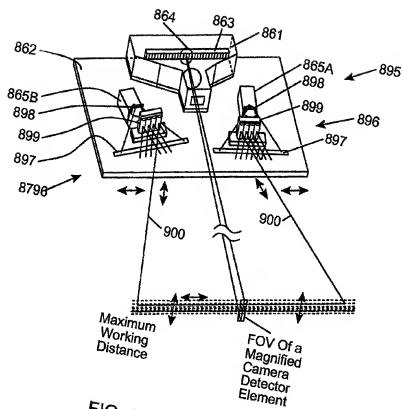
$$T_{\text{eff}}^{\text{eff}} = T_{\text{eff}} + \frac{1}{2} \left(\frac{T_{\text{eff}}}{T_{\text{eff}}} \right)^2$$


FIG. 1/25D1

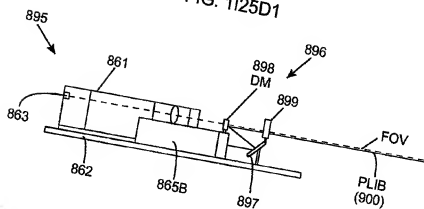


FIG. 1125D2

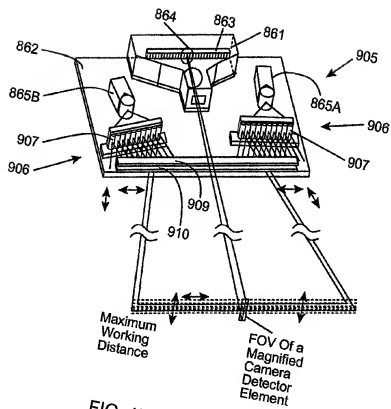


FIG. 1125E1

* Lateral And Transverse Micro-oscillation Of PLIB

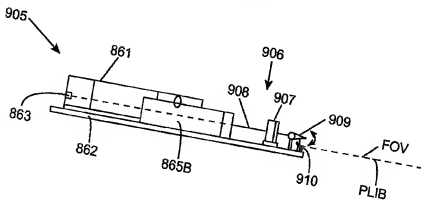


FIG. 1125E2

FIG. 1125F1

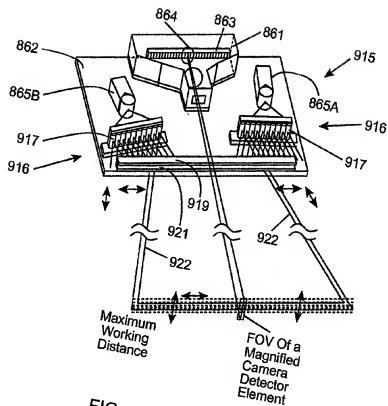


FIG. 1125F1

* Lateral And Transverse Micro-oscillation Of PLIB

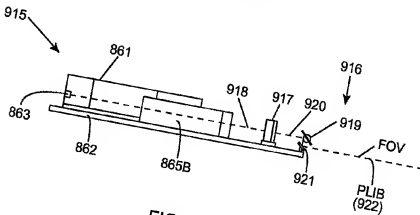


FIG. 1125F2

FIG. 1125G1

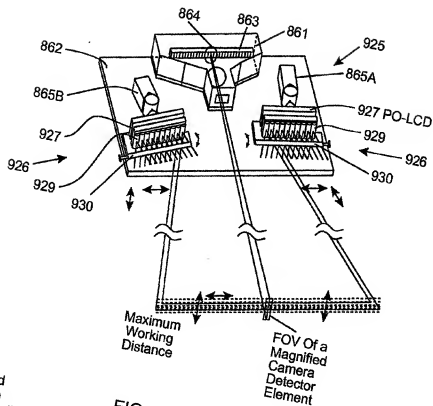


FIG. 1125G1

* Lateral And Transverse Micro-oscillation Of PLIB

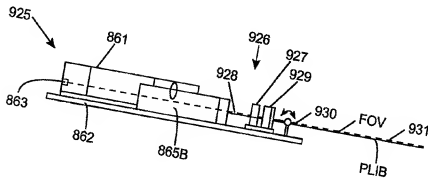


FIG. 1125G2

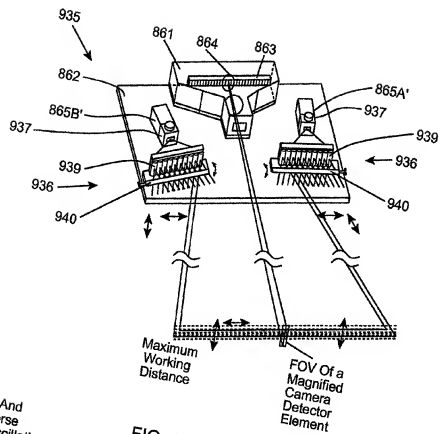


FIG. 1I25H1

* Lateral And
Transverse
Micro-oscillation
Of PLIB

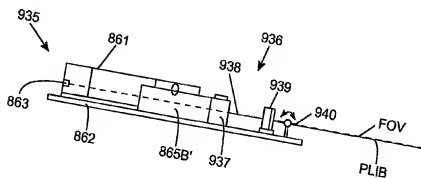
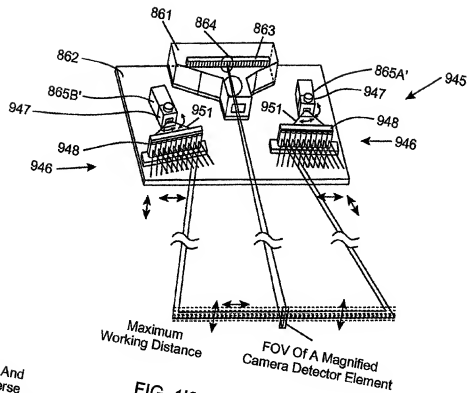
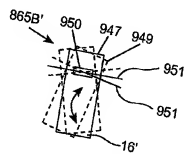
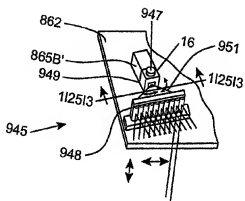


FIG. 1I25H2



* Lateral And
Transverse
Micro-oscillation
Of PLIB



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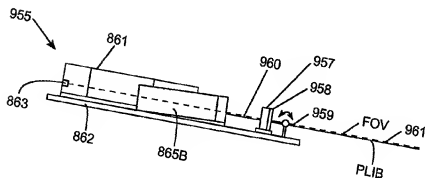
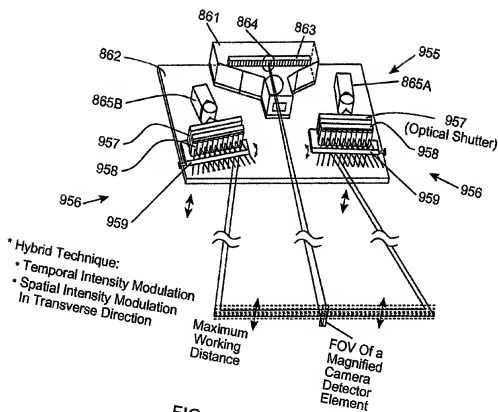


FIG. 1125K1

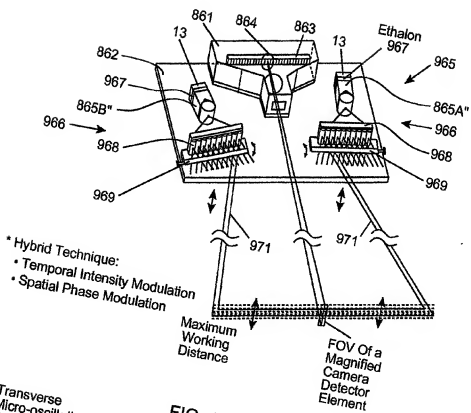


FIG. 1125K1

* Transverse Micro-oscillation Of PLIB

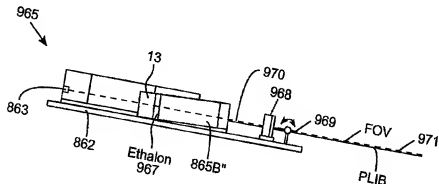


FIG. 1125K2

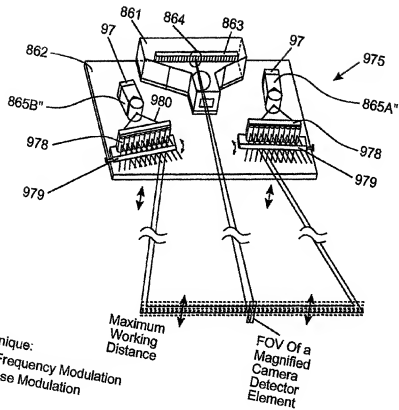


FIG. 1125L1

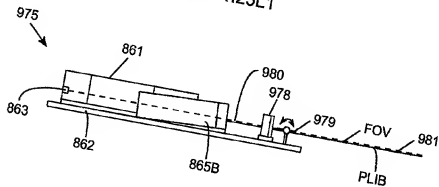
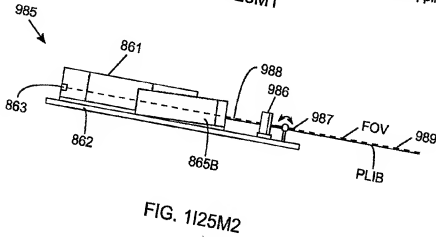
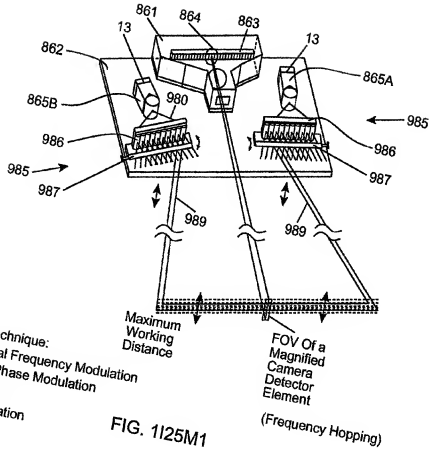
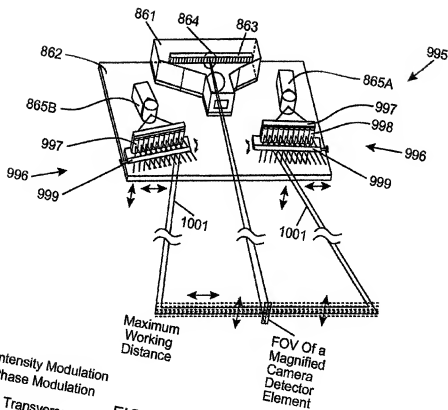


FIG. 1125L2

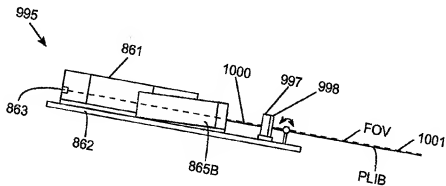
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2025/11/26 16:00



- * Hybrid:
 - Spatial Intensity Modulation
 - Spatial Phase Modulation
- * Lateral And Transverse Micro-oscillation Of PLIB



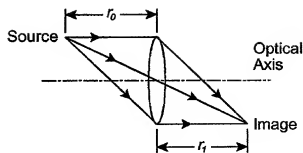


FIG. 1H1

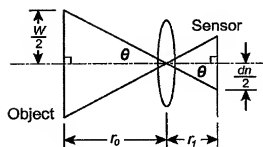


FIG. 1H2

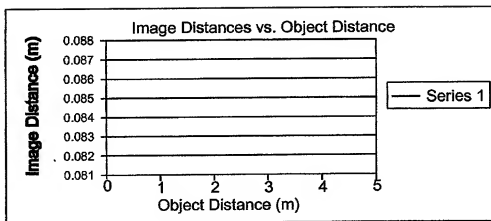


FIG. 1H3

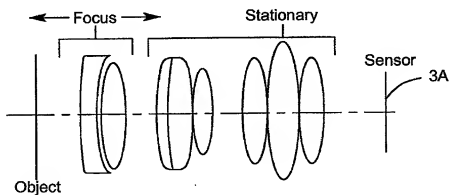


FIG. 1H4

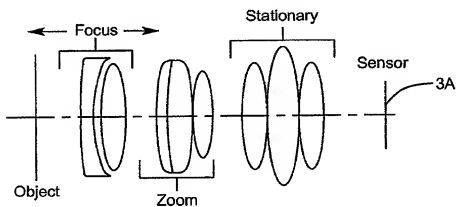


FIG. 1H5

Fixed Focal Length

Lens Cases

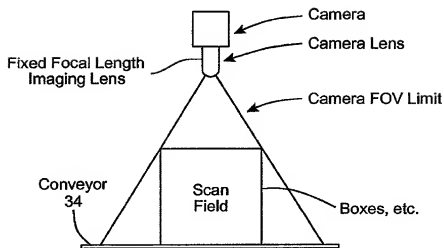


FIG. 1K1

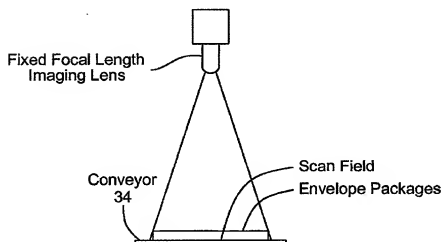


FIG. 1K2

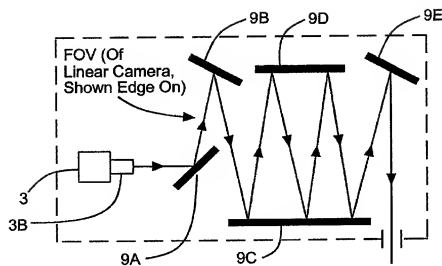


FIG. 1L1

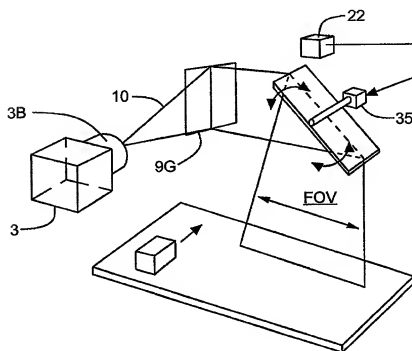


FIG. 1L2

202170-66376001

Pixel Power Density vs. Object Distance (General Example)

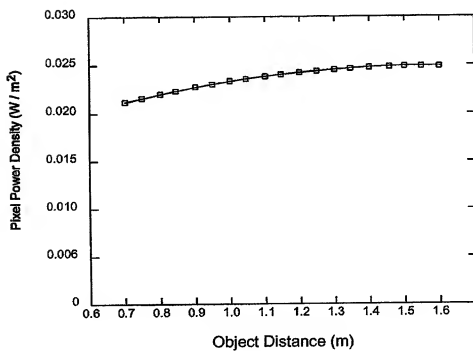


FIG. 1M1

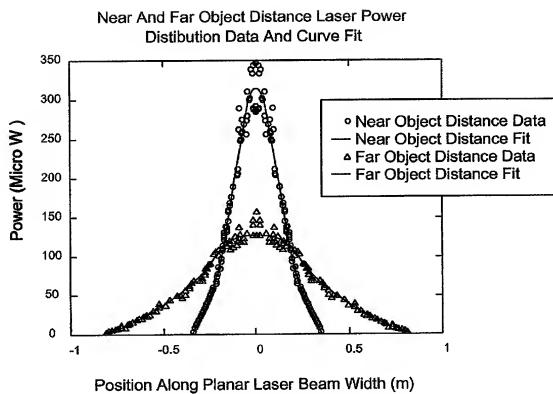


FIG. 1M2

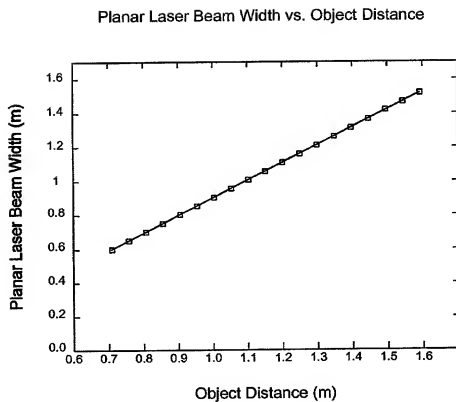


FIG. 1M3

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Planar Laser Beam Height vs.
Object Distance (Far Object Distance Focus)

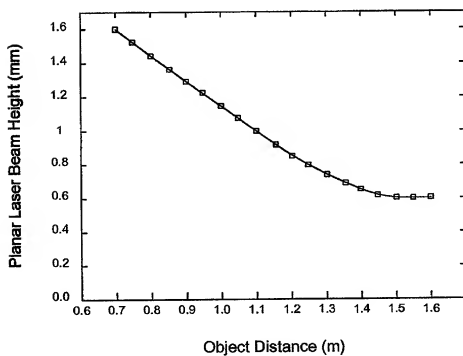


FIG. 1M4

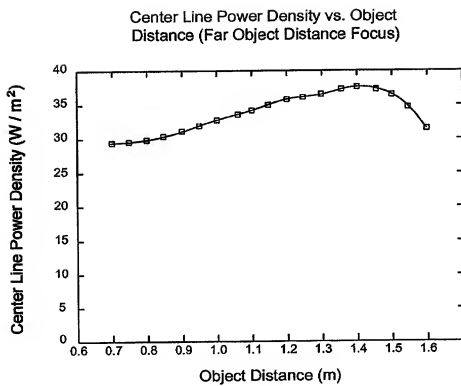


FIG. 1N

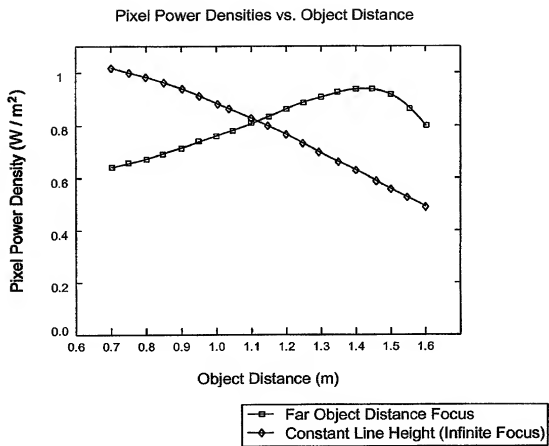
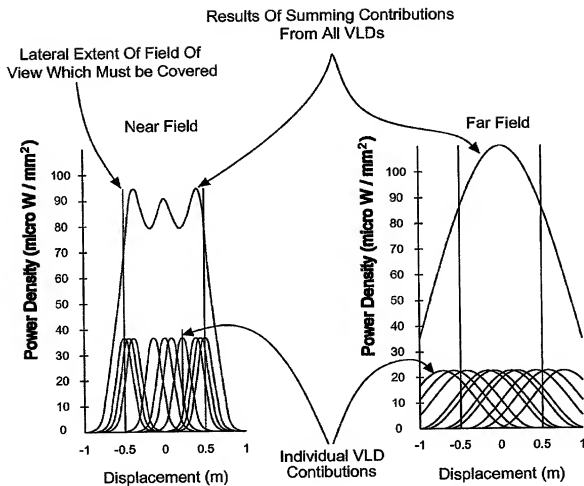


FIG. 10



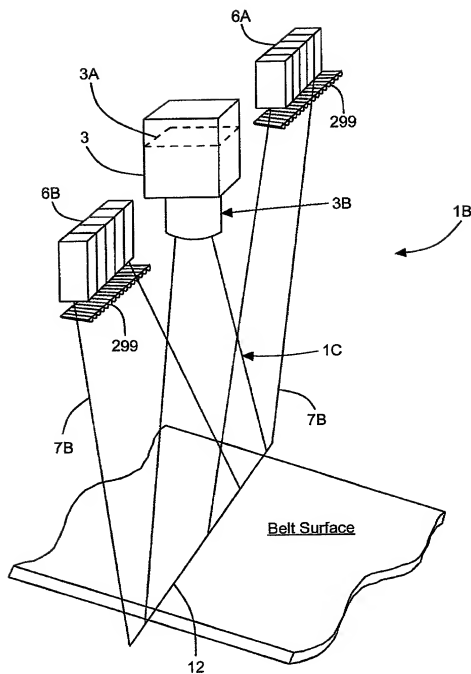


FIG. 1Q1

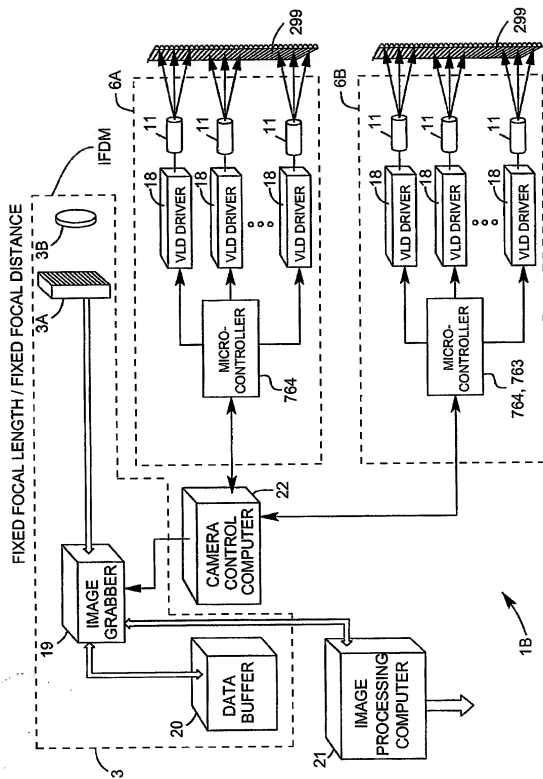


FIG. 1Q2

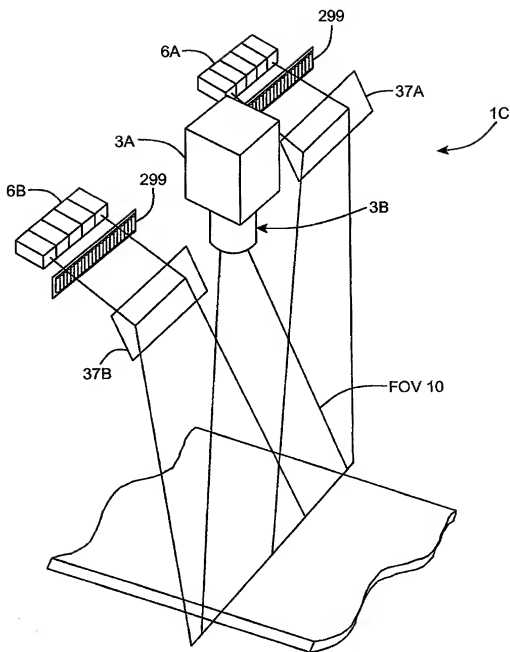
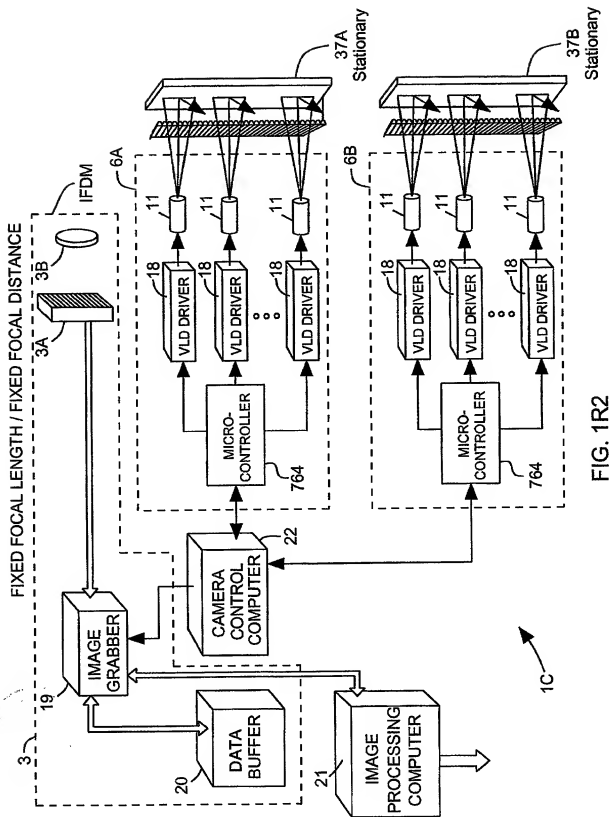


FIG. 1R1



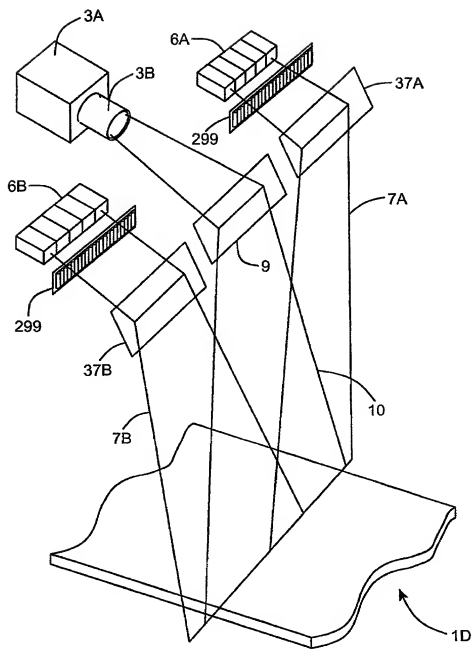


FIG. 1S1

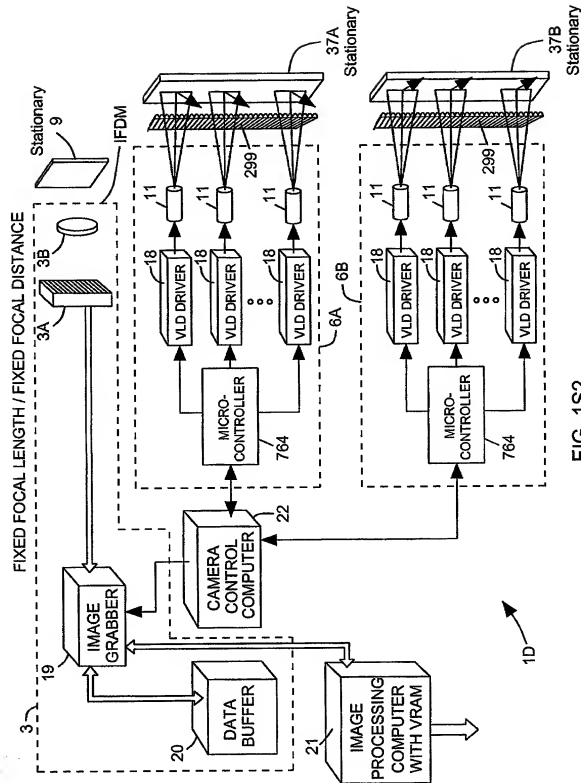


FIG. 1S2

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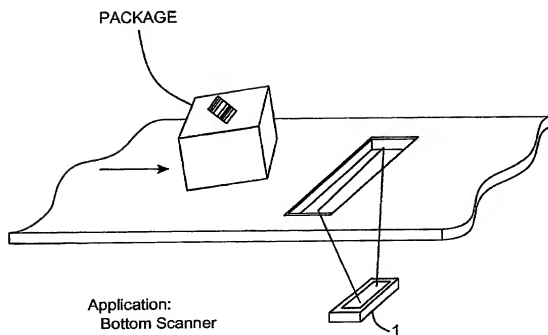
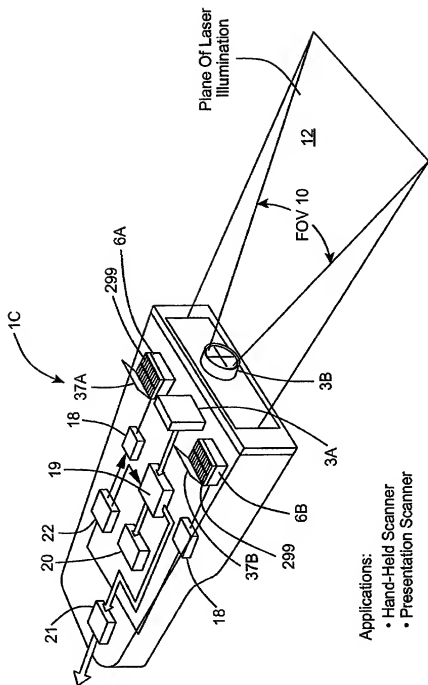


FIG. 1T



Applications:

- Hand-Held Scanner
- Presentation Scanner

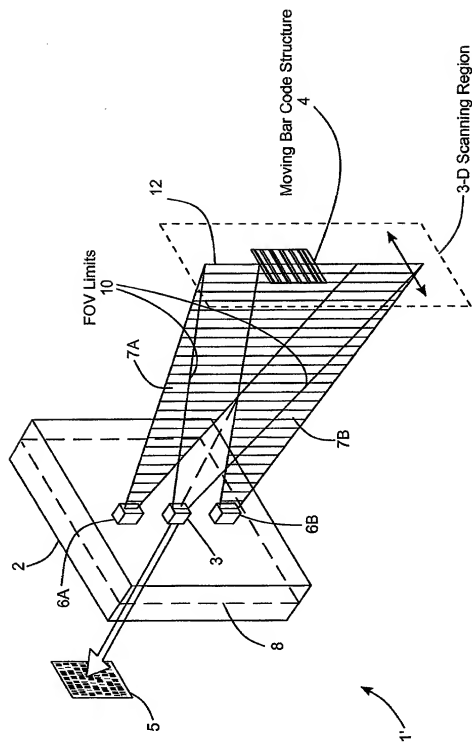


FIG. 1V1

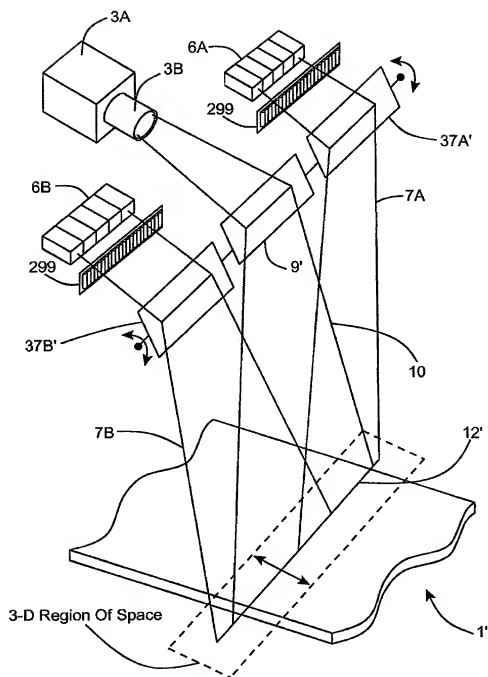


FIG. 1V2

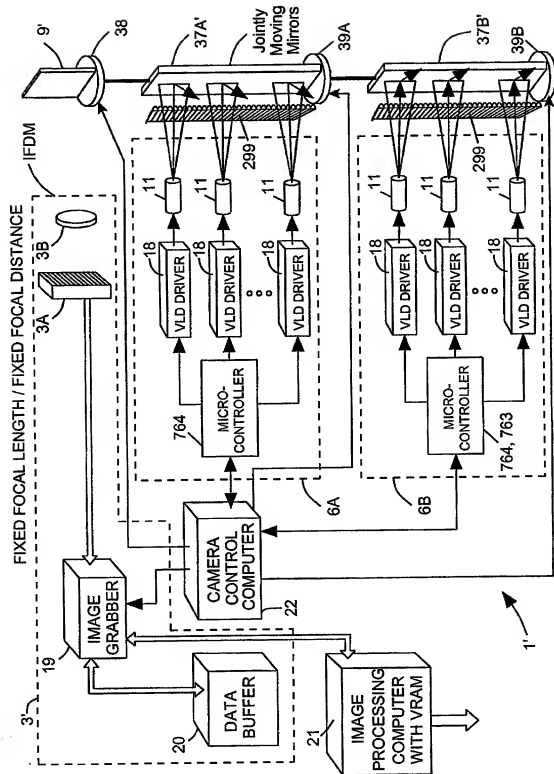


FIG. 1V3

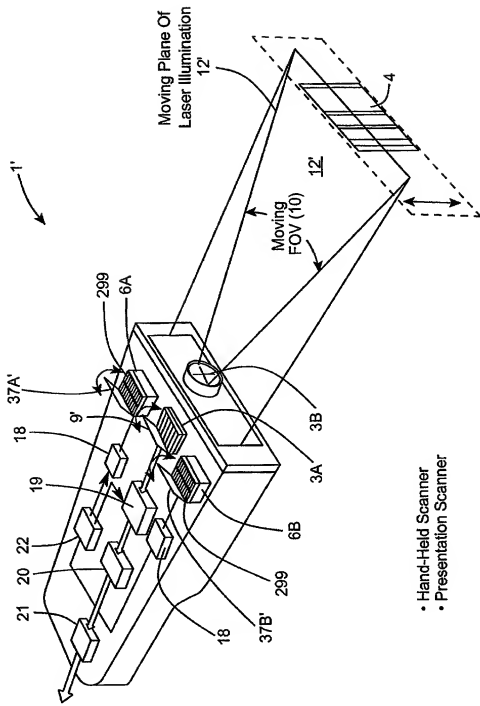


FIG. 1V4

- Hand-Held Scanner
- Presentation Scanner

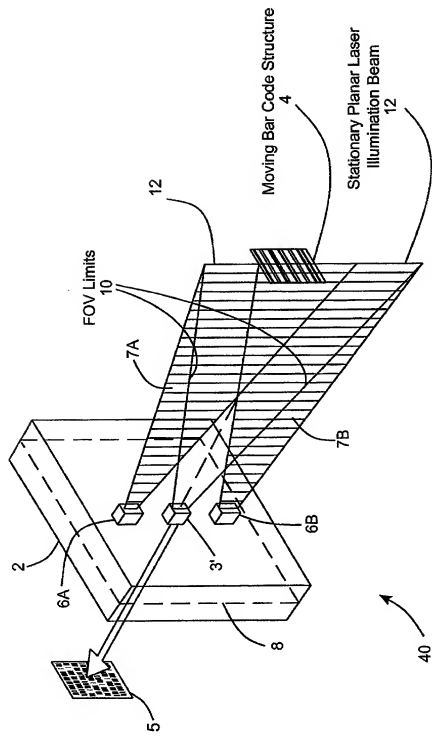


FIG. 2A

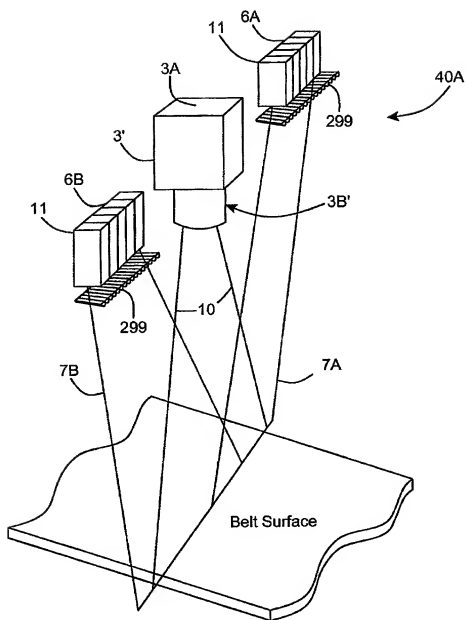


FIG. 2B1

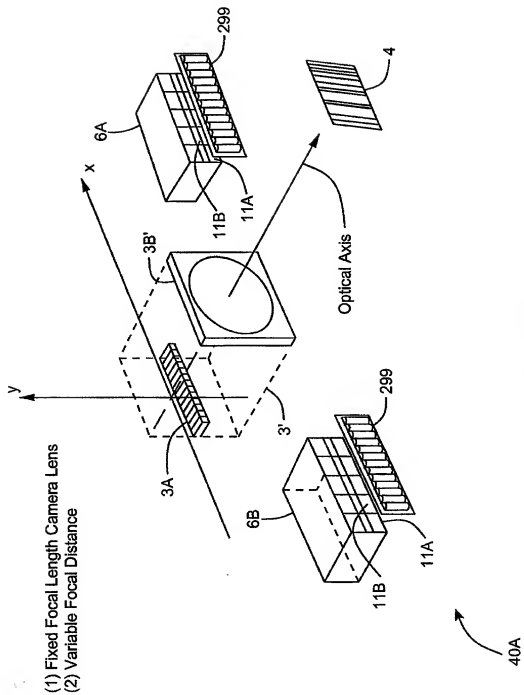


FIG. 2B2

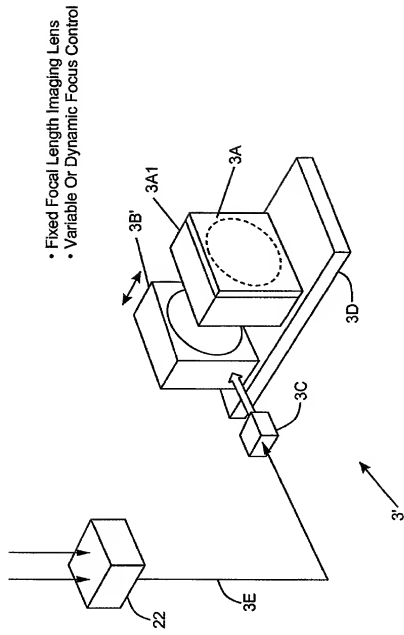


FIG. 2C2

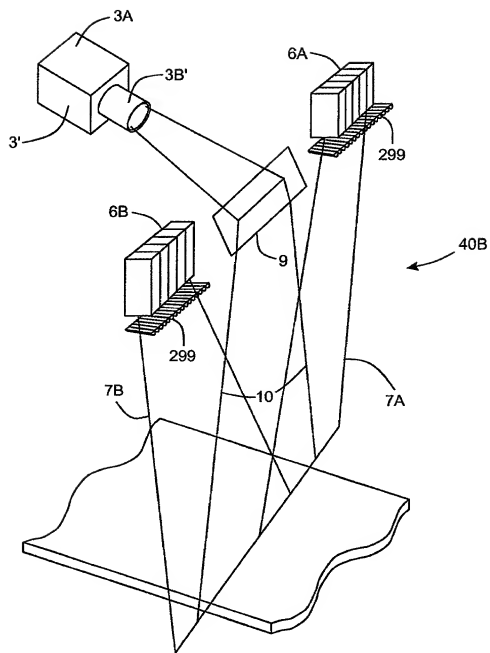


FIG. 2D1

11/9/397

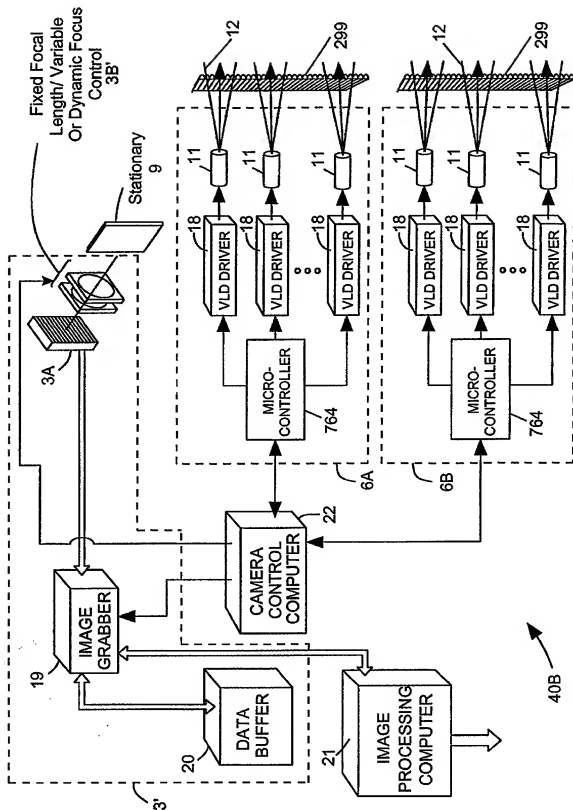


FIG. 2D2

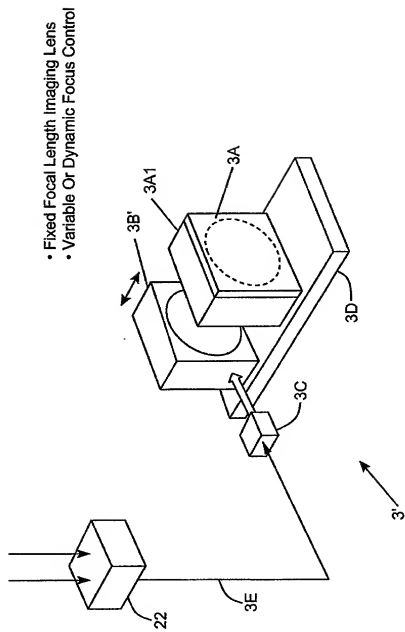


FIG. 2D3

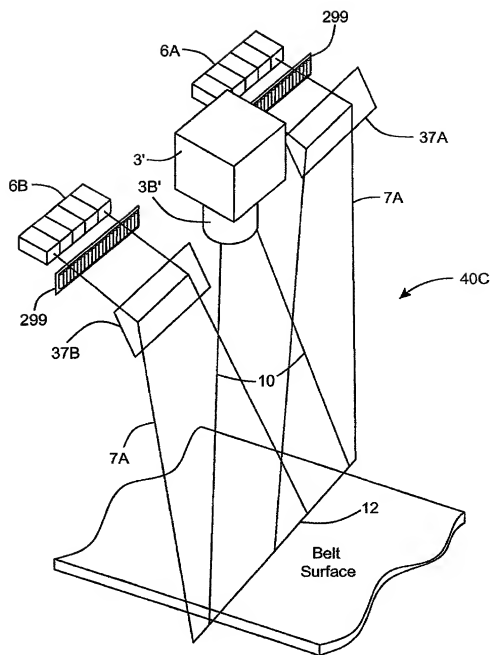


FIG. 2E1

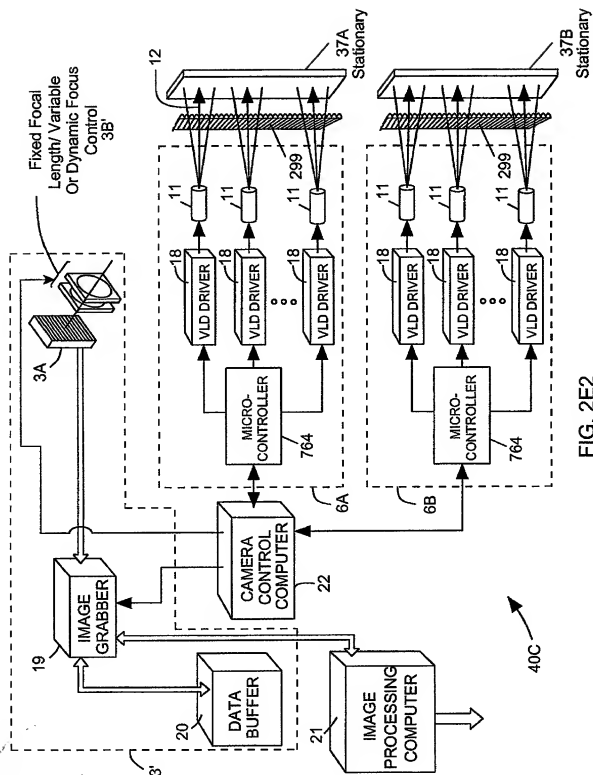


FIG. 2E2

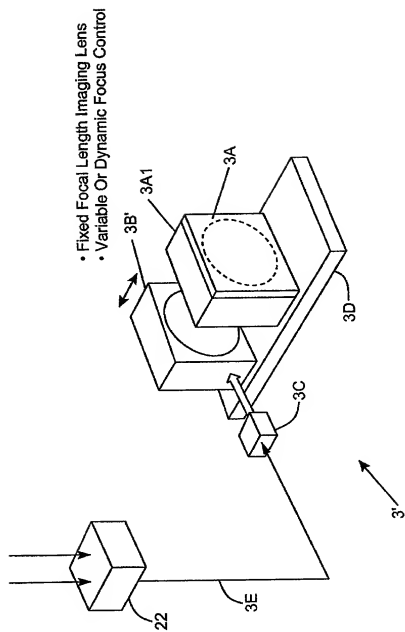
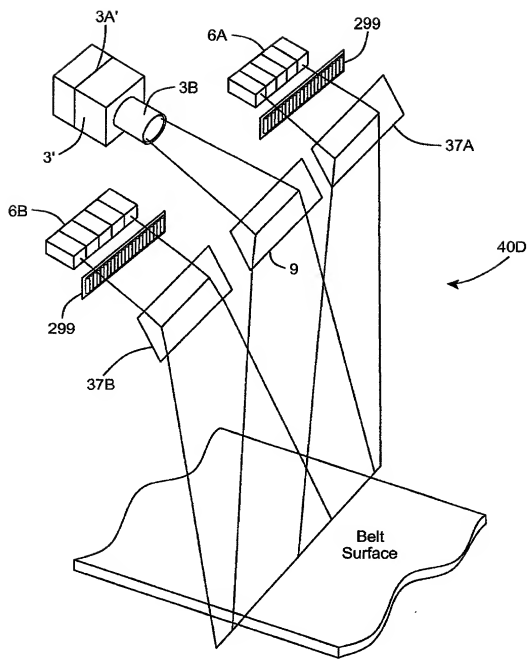


FIG. 2E3



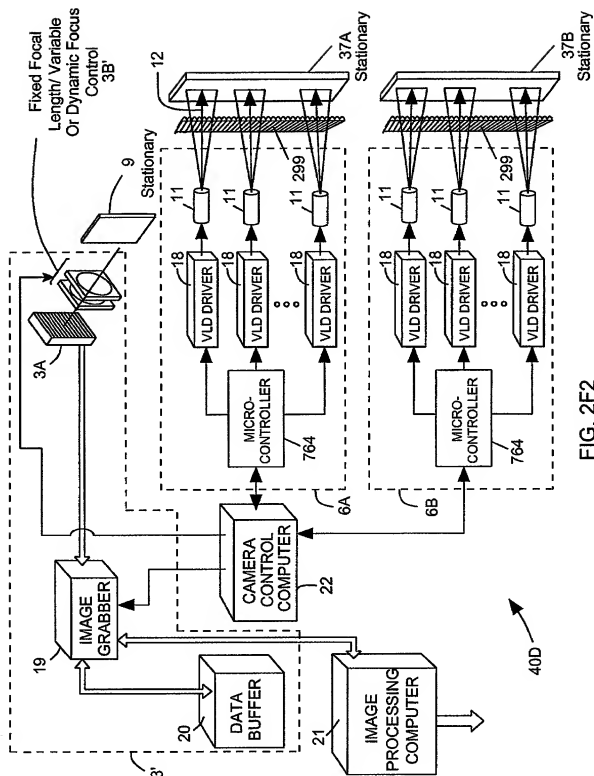


FIG. 2F2

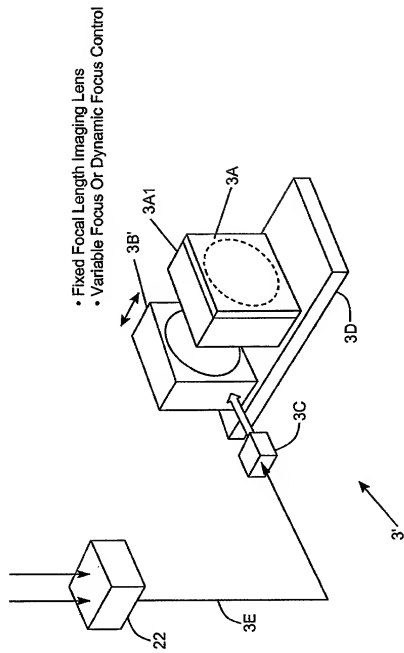


FIG. 2F3

Top Conveyor Scanner:

- Fixed Focal Length Imaging Lens
- Variable Focal Distance Control

Side Conveyor Scanner:

- Fixed Focal Length Imaging Lens
- Dynamic Focal Distance Control

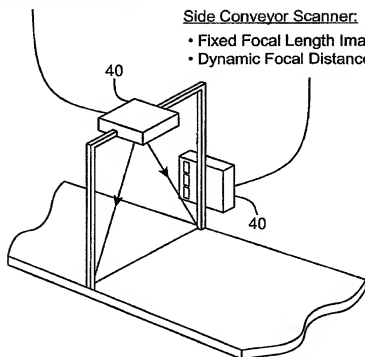


FIG. 2G

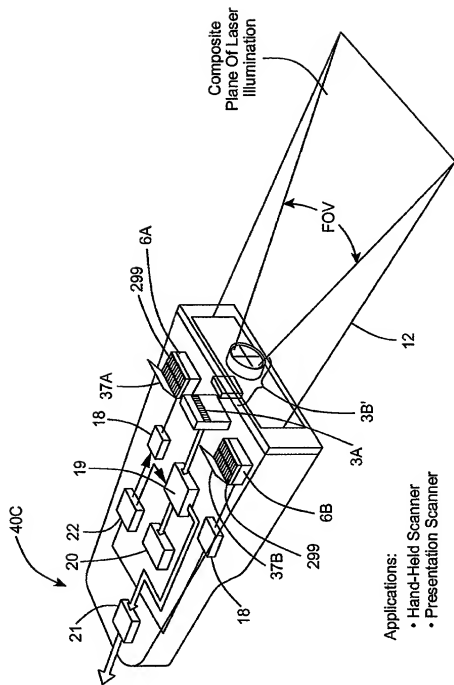


FIG. 2H

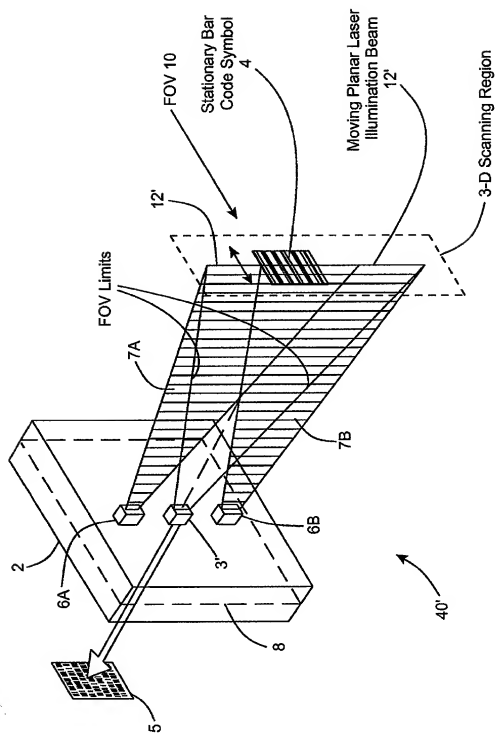


FIG. 211

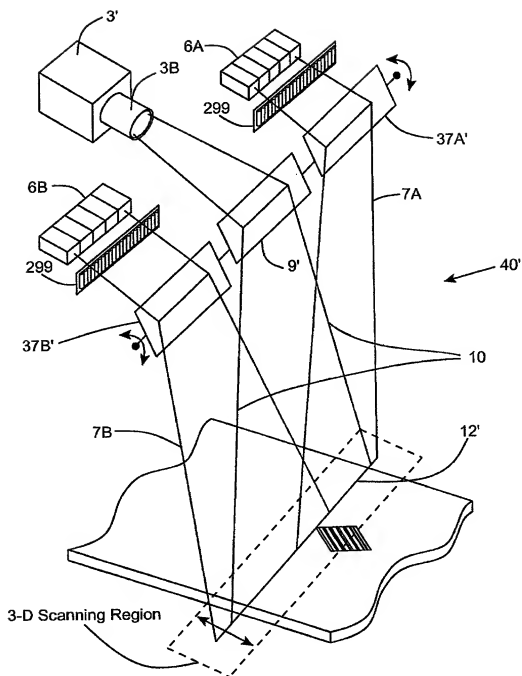


FIG. 212

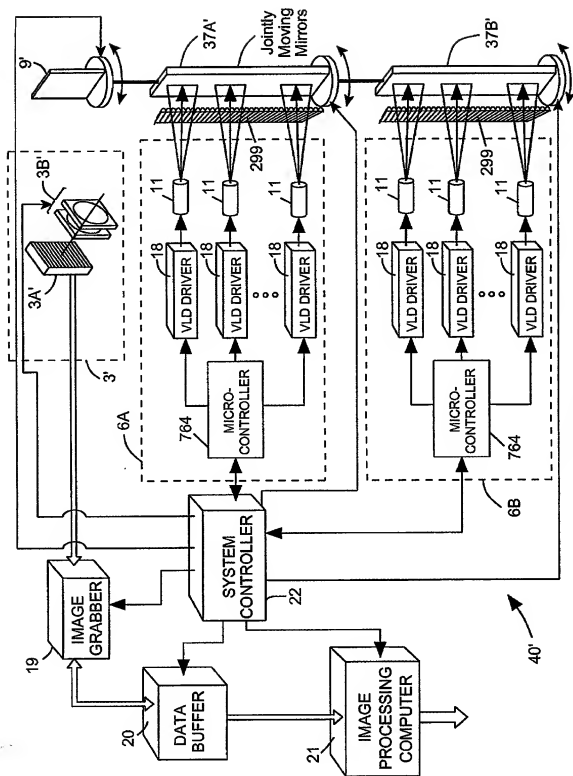


FIG. 213

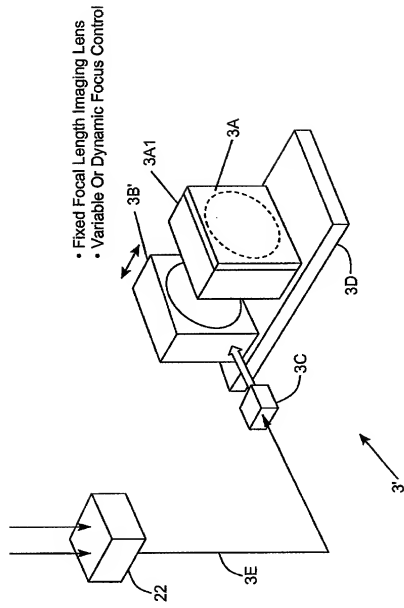


FIG. 214

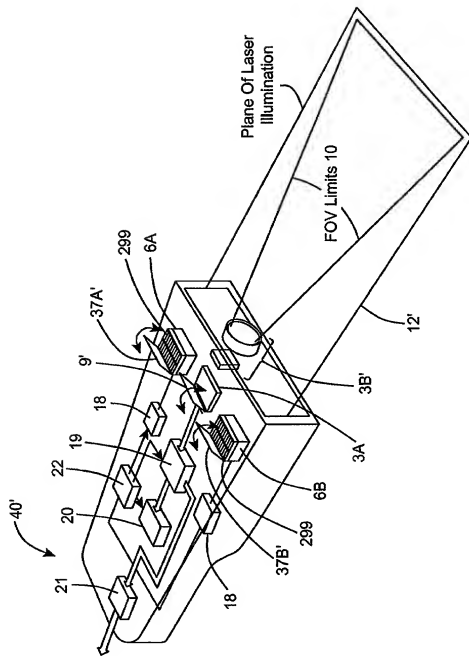


FIG. 215

10091339

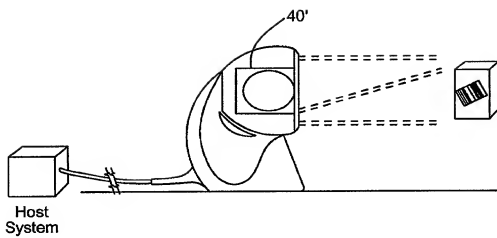


FIG. 216

10091339-071202

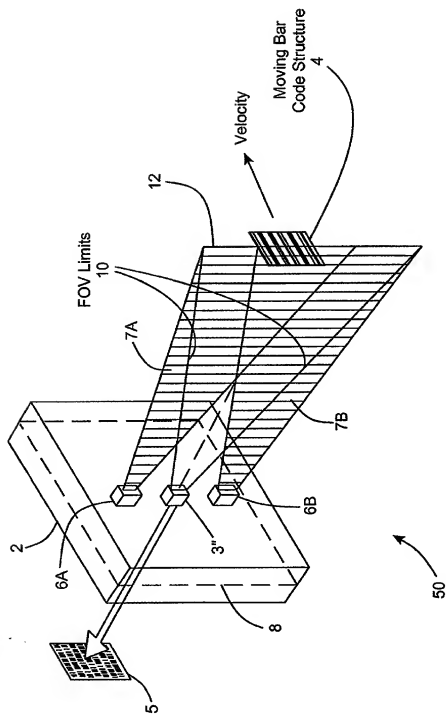


FIG. 3A

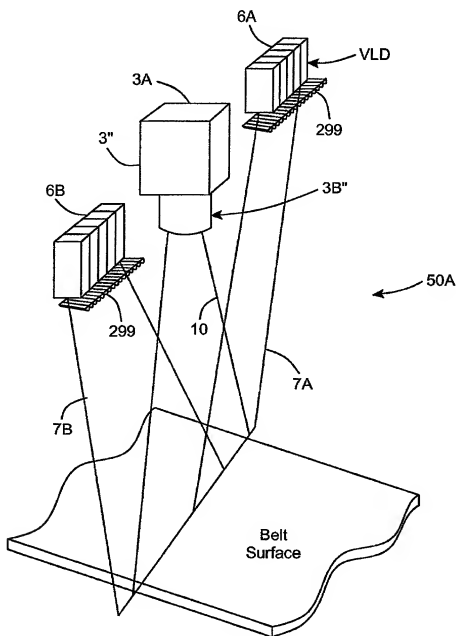


FIG. 3B1

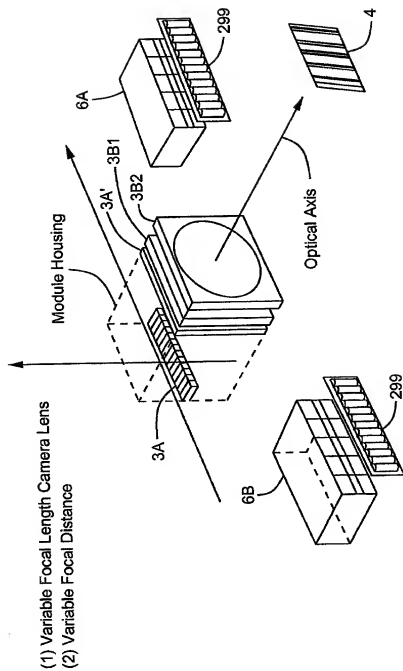


FIG. 3B2

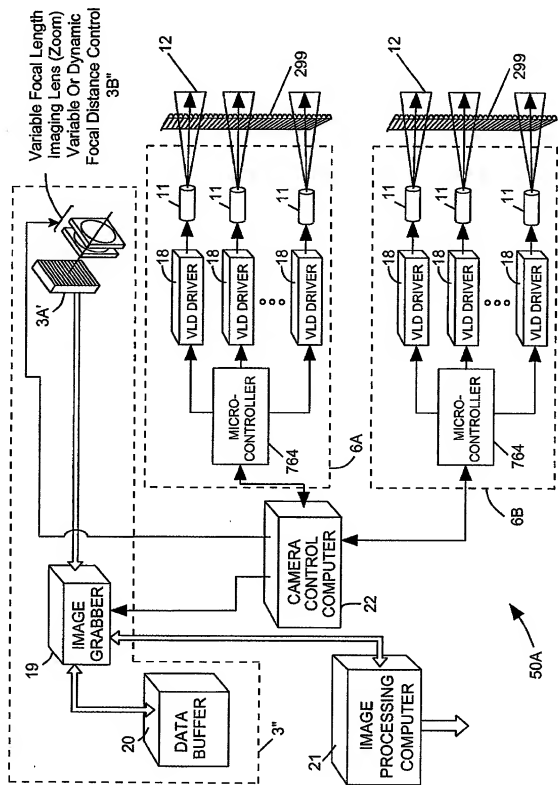
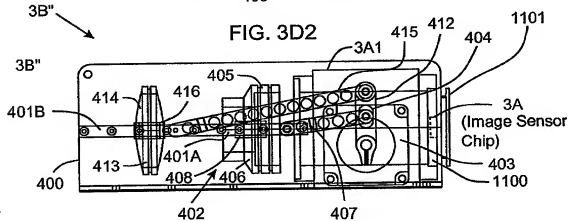
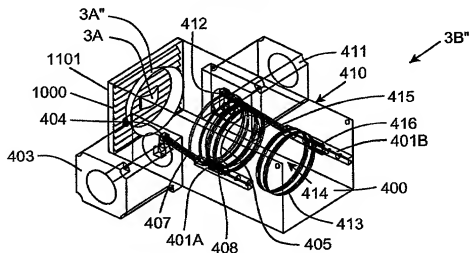
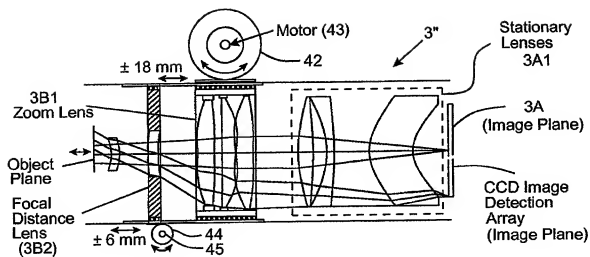


FIG. 3C1



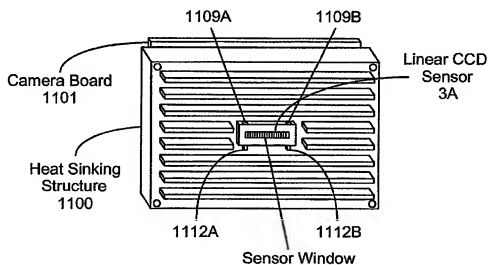


FIG. 3D4

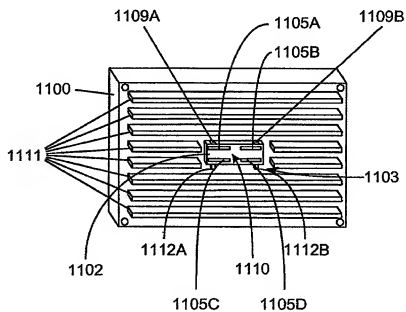


FIG. 3D5

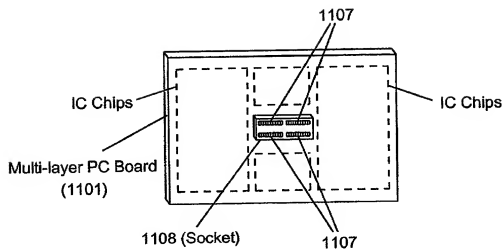


FIG. 3D6

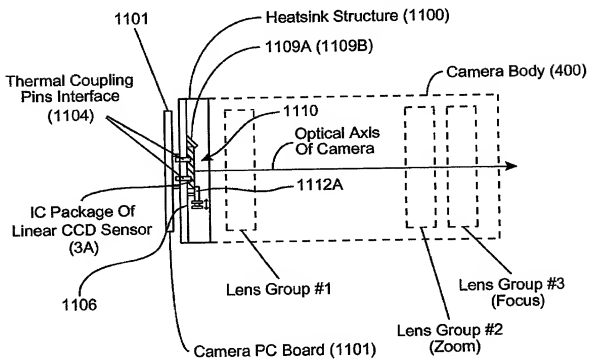


FIG. 3D7

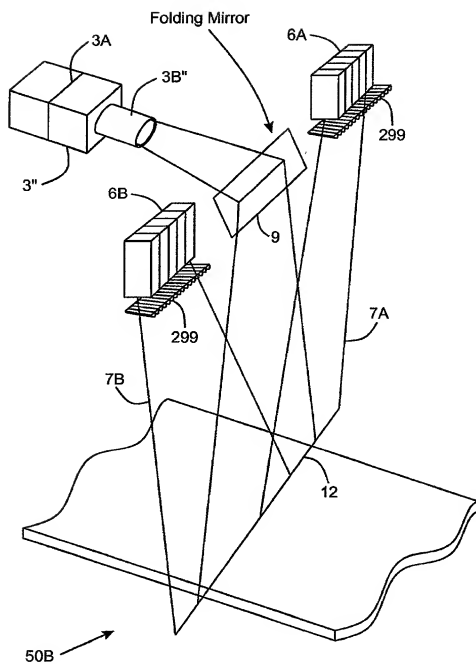


FIG. 3E1

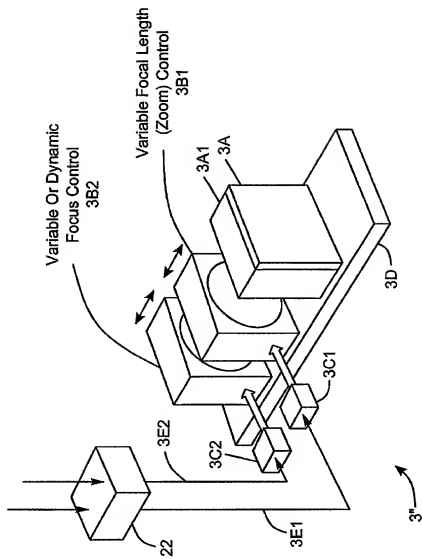


FIG. 3E3

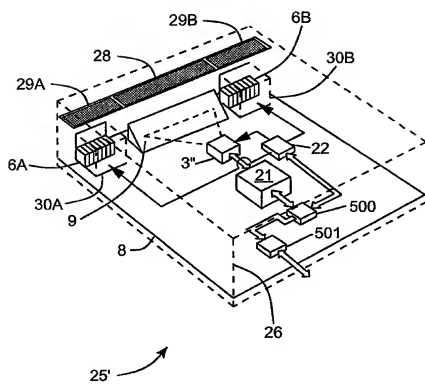
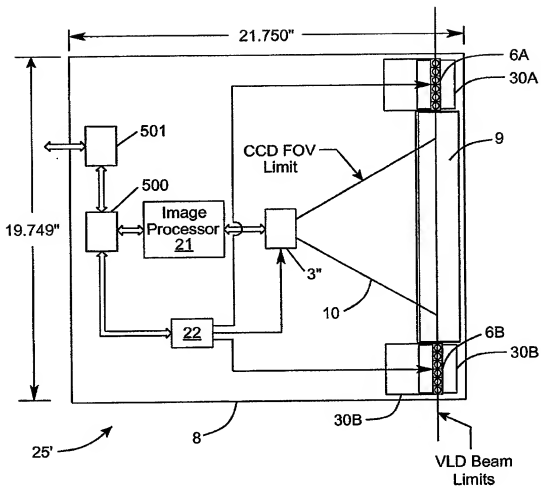


FIG. 3E4



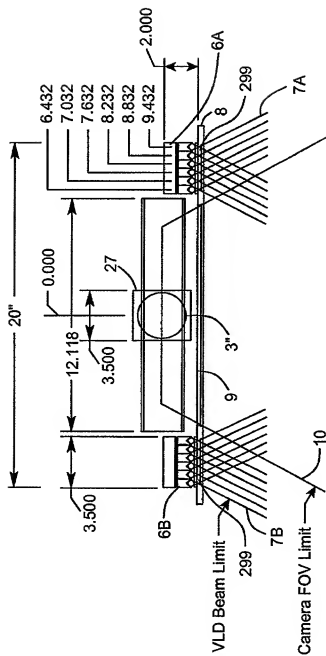


FIG. 3E6

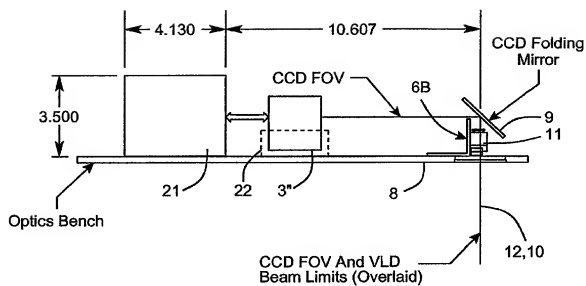


FIG. 3E7

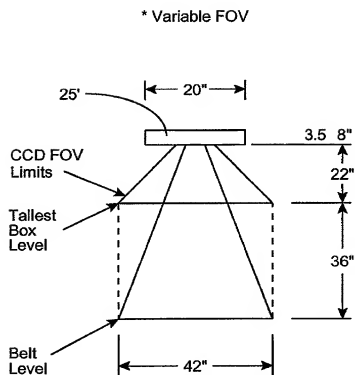


FIG. 3E8

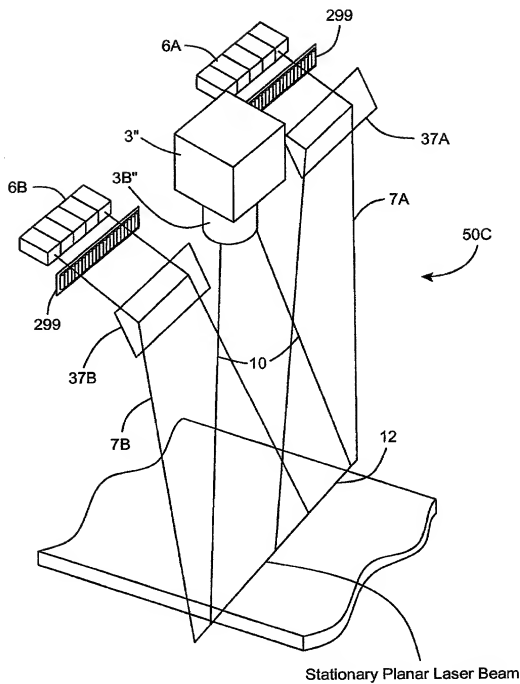


FIG. 3F1

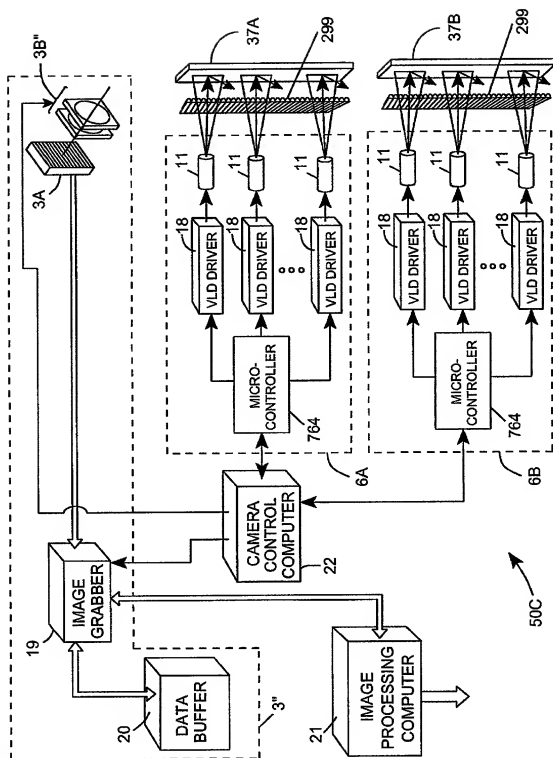


FIG. 3F2

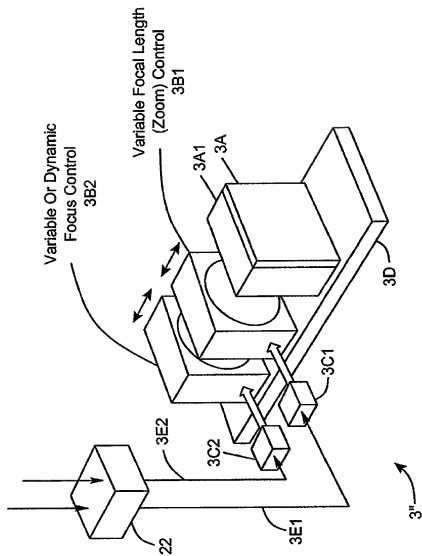


FIG. 3F3

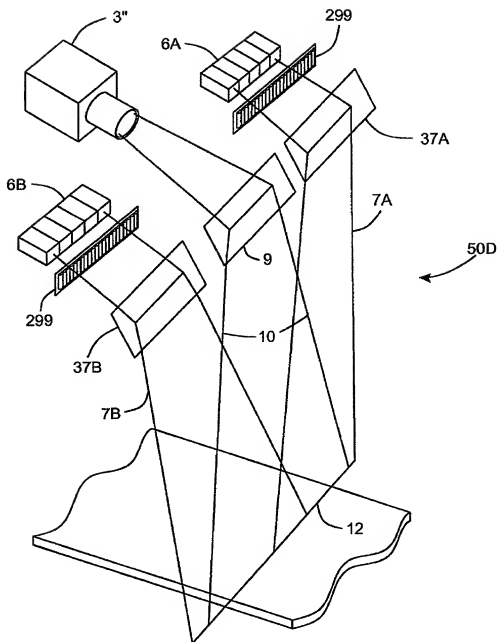


FIG. 3G1

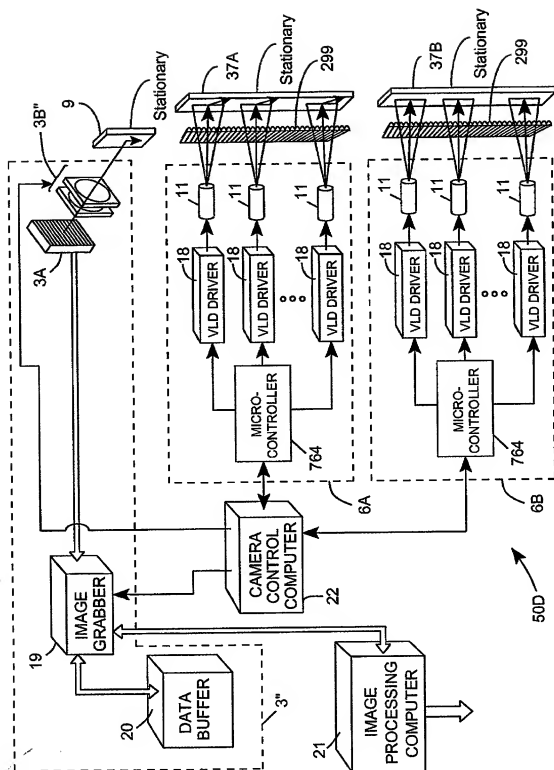


FIG. 3G2

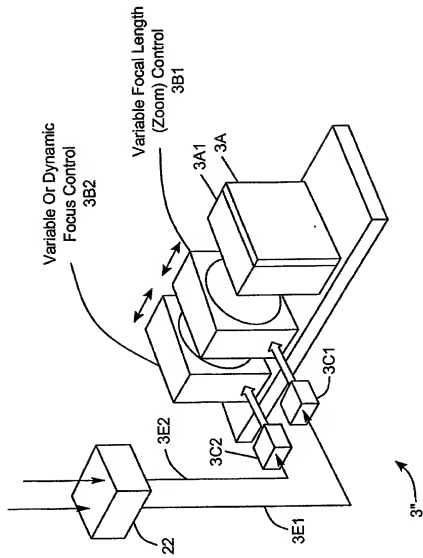


FIG. 3G3

- Variable Focal Length Imaging Lens
- Variable Focal Distance

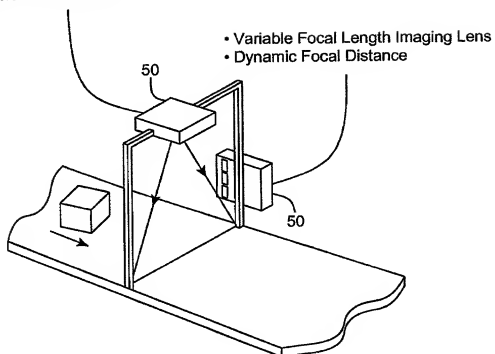


FIG. 3H

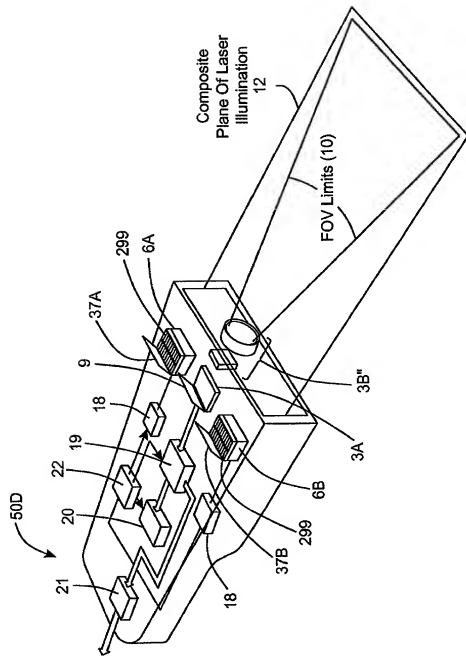
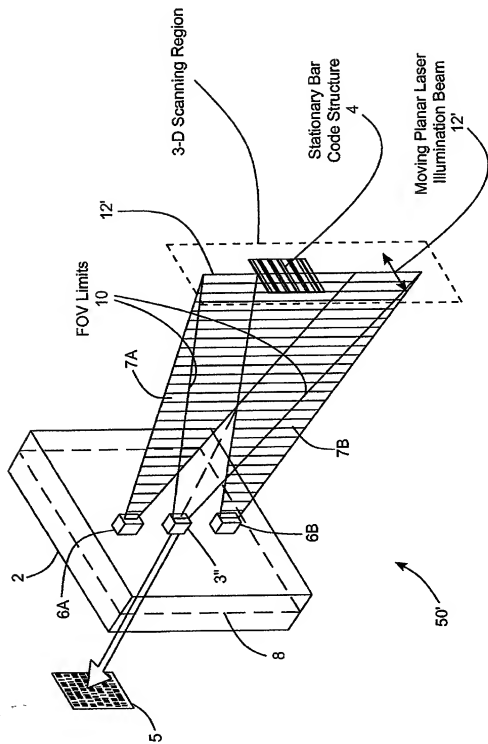


FIG. 3I



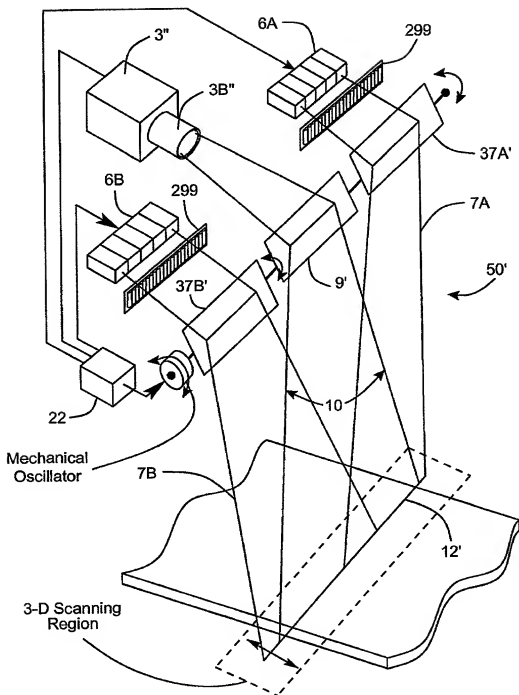


FIG. 3J2

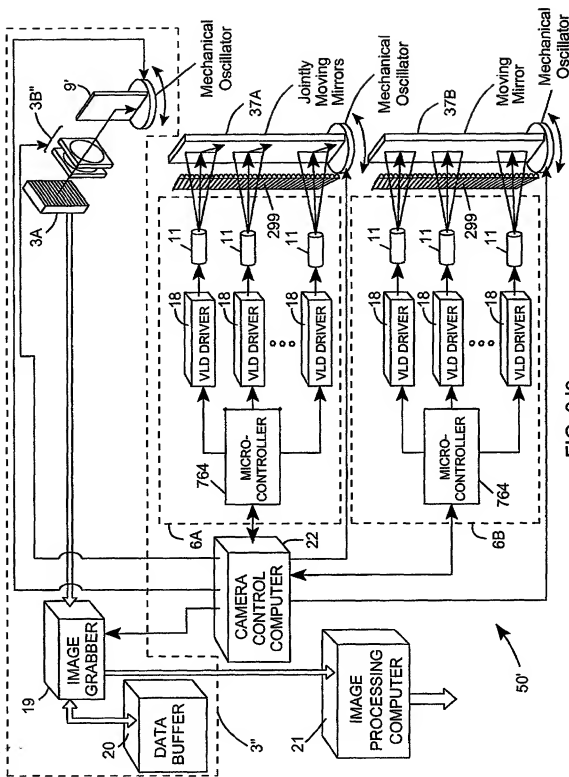


FIG. 3J3

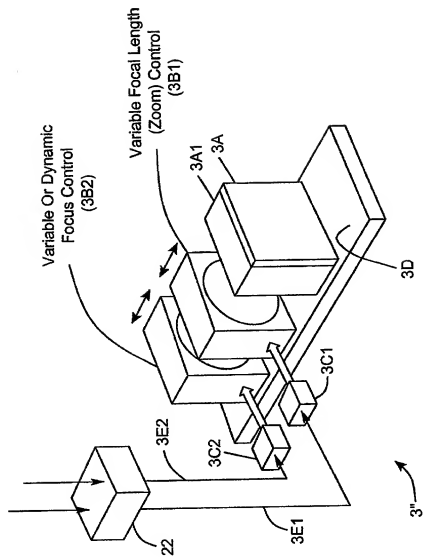


FIG. 3J4

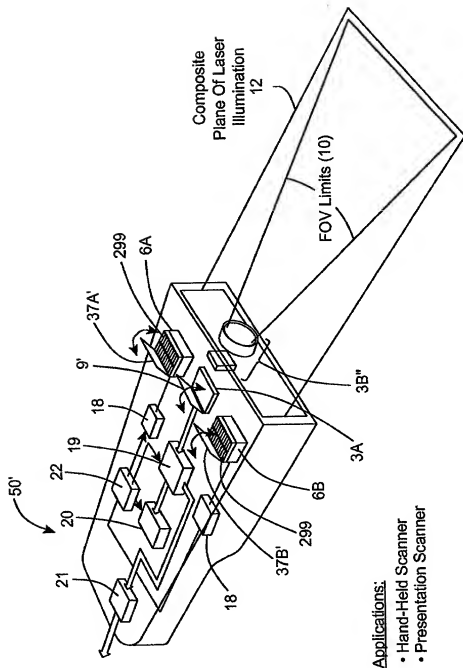
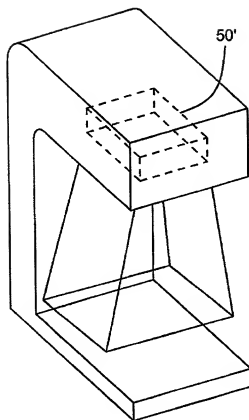


FIG. 3J5



2-D Hold-under Scanner

FIG. 3J6

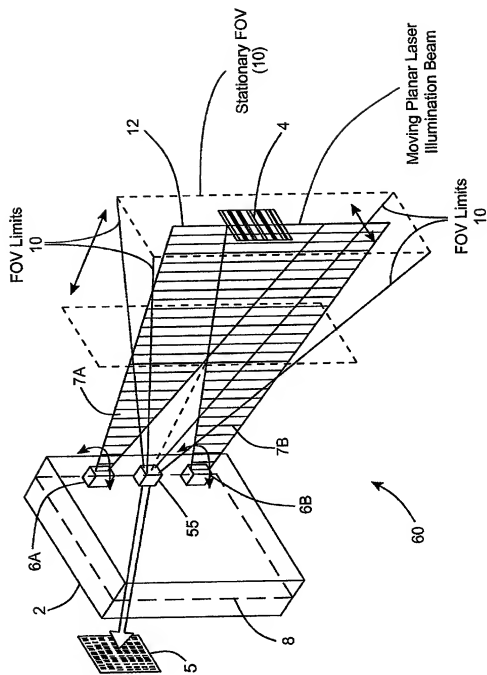


FIG. 4A

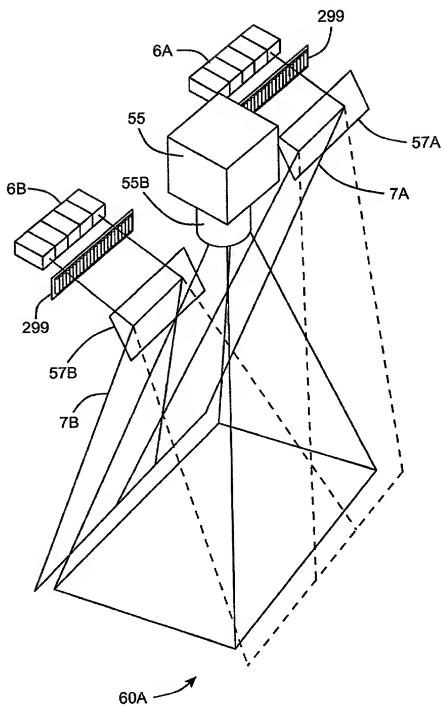


FIG. 4B1

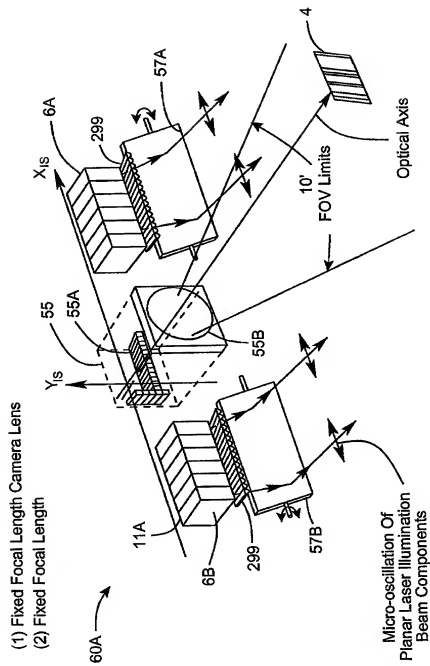
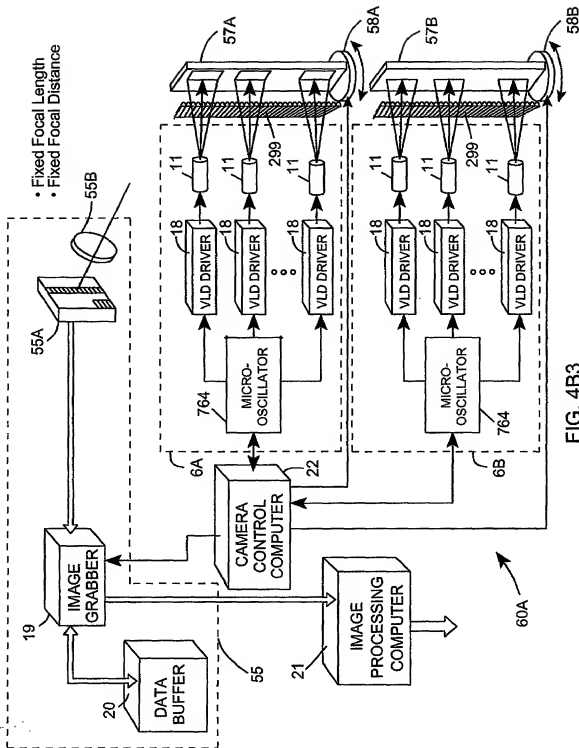


FIG. 4B2



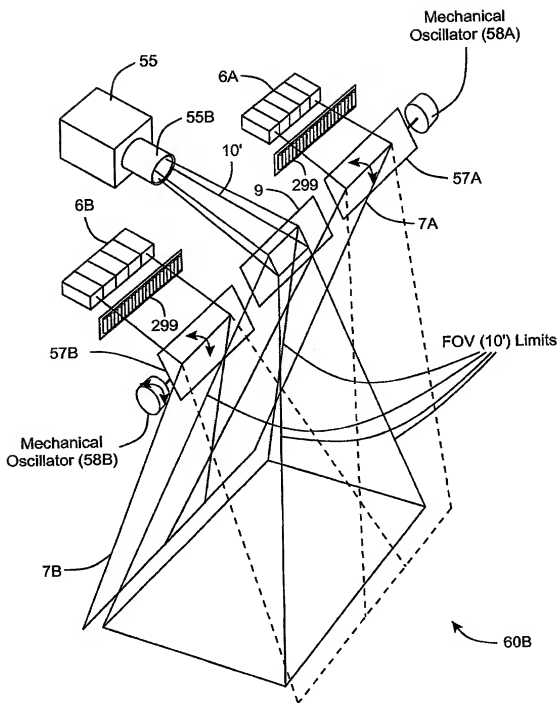


FIG. 4C1

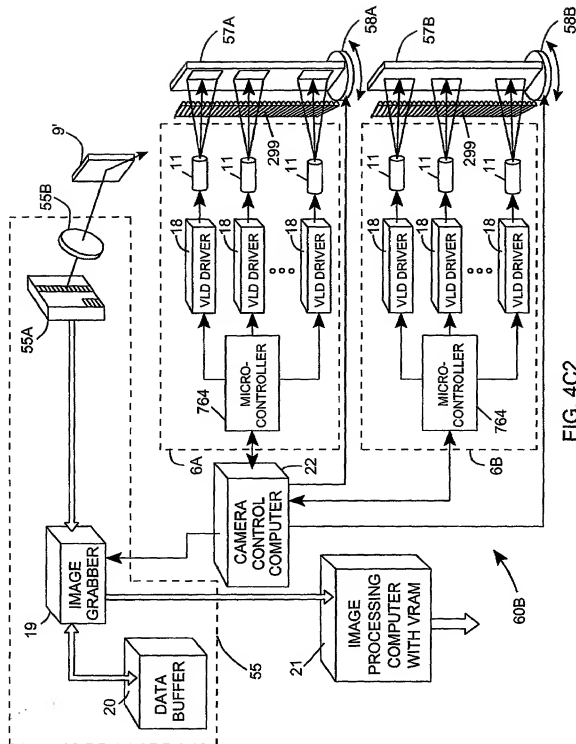
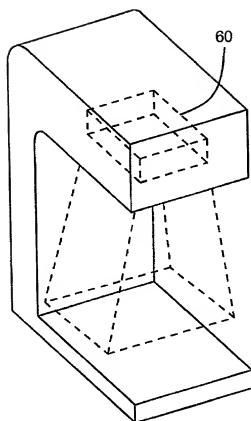


FIG. 4C2



2-D Hold-under Scanner

FIG. 4D

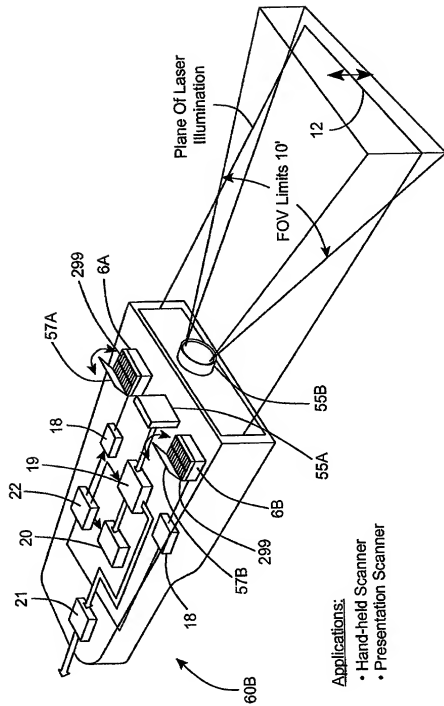


FIG. 4E

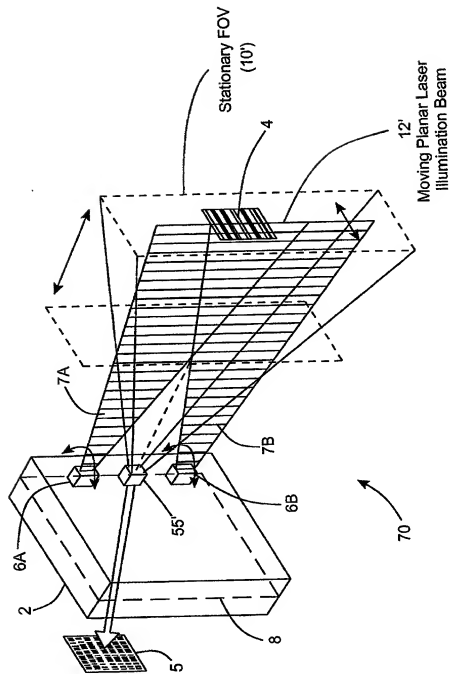


FIG. 5A

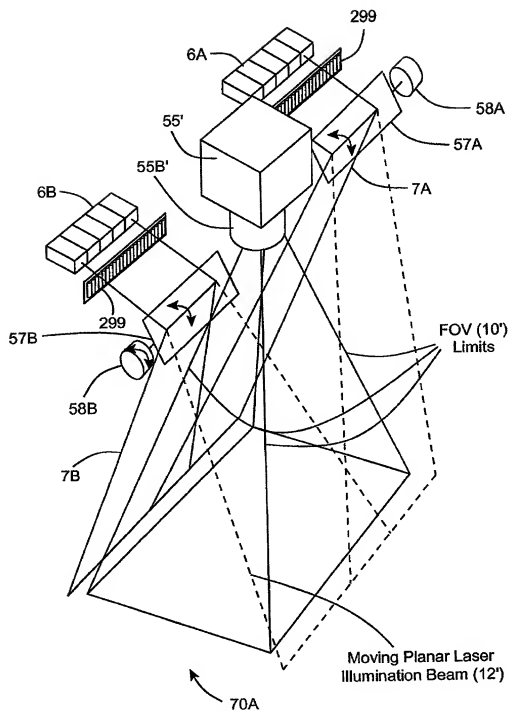


FIG. 5B1

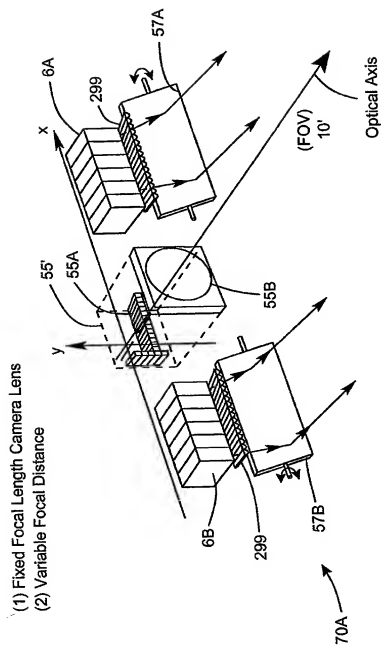


FIG. 5B2

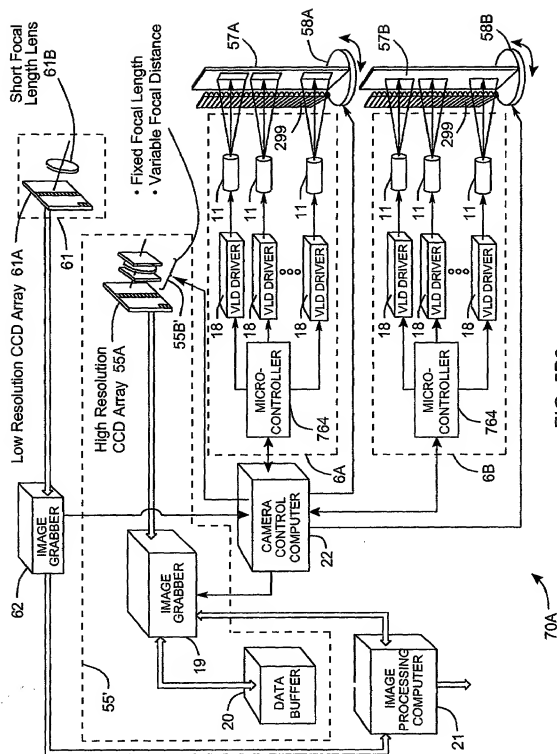


FIG. 5B3

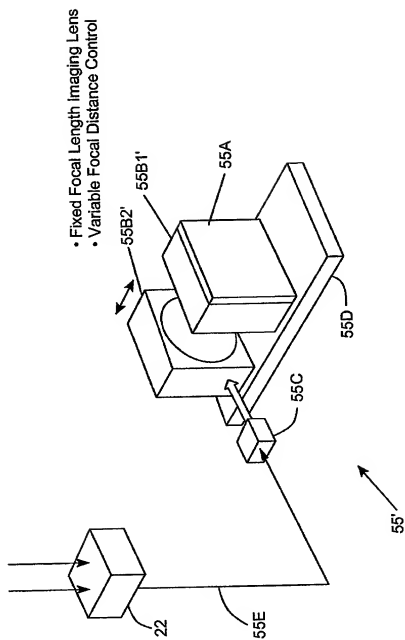


FIG. 5B4

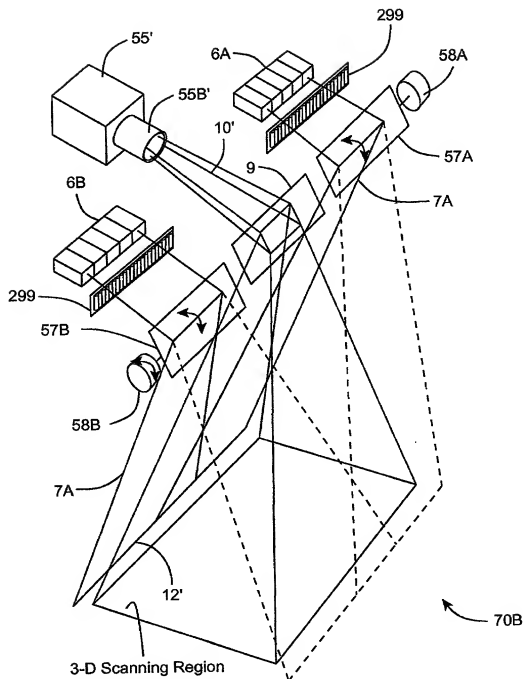


FIG. 5C1

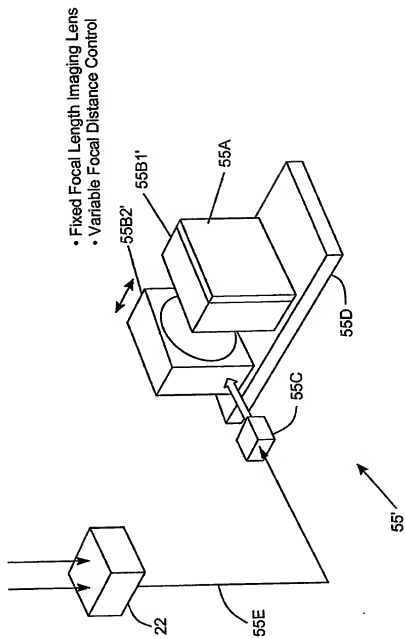


FIG. 5C4

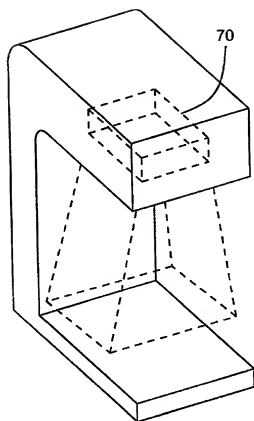


FIG. 5D

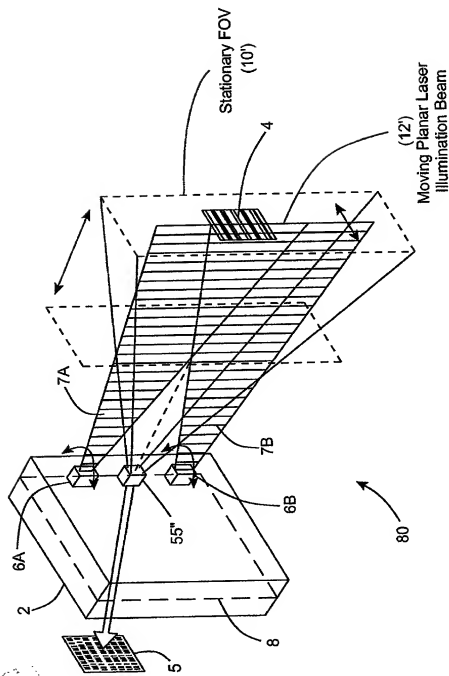


FIG. 6A

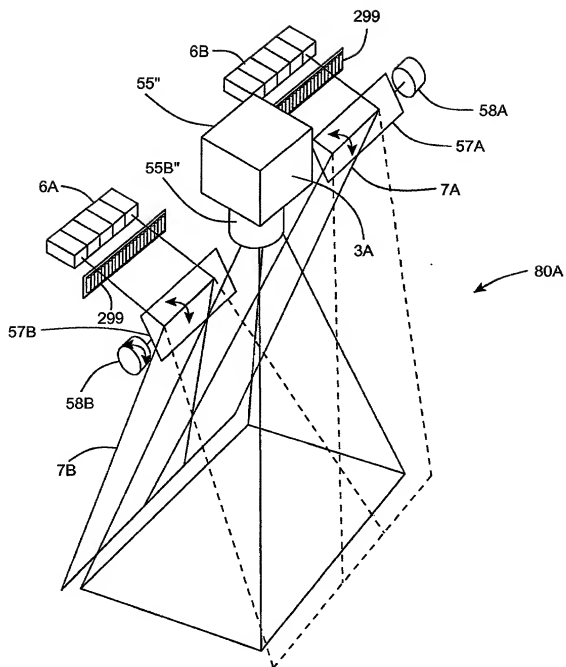
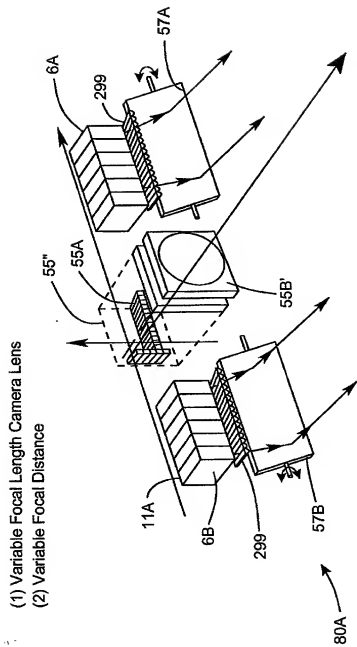


FIG. 6B1



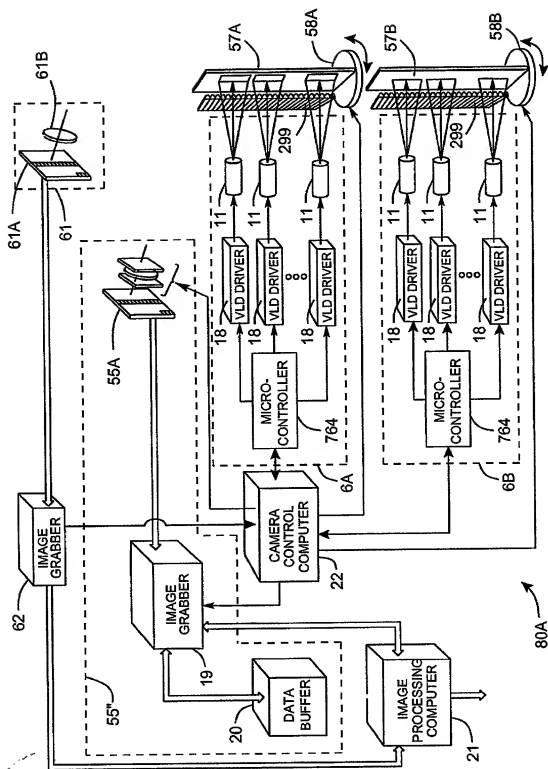


FIG. 6B3

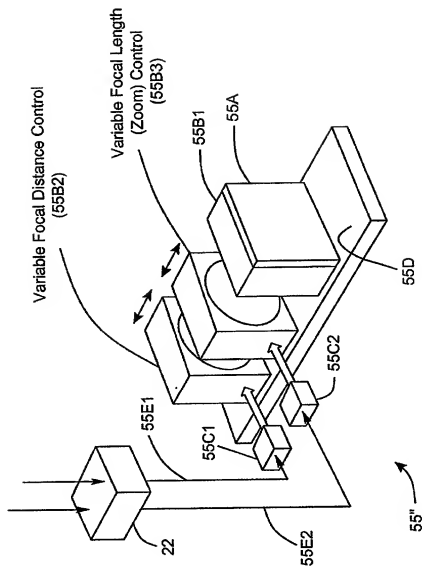


FIG. 6B4

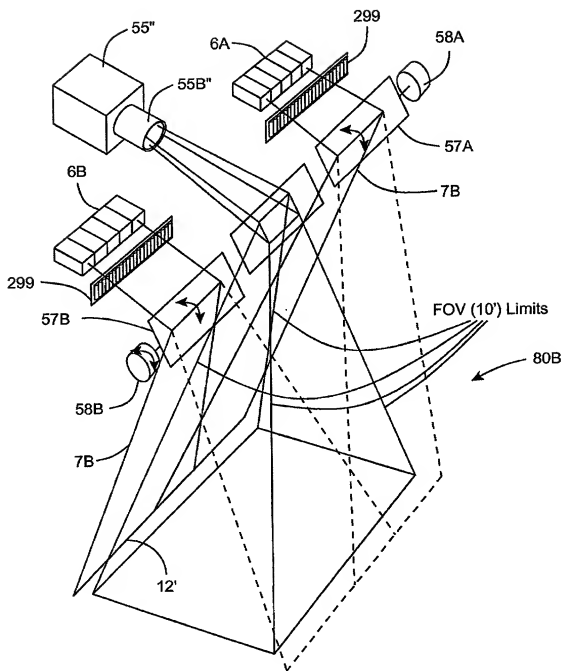
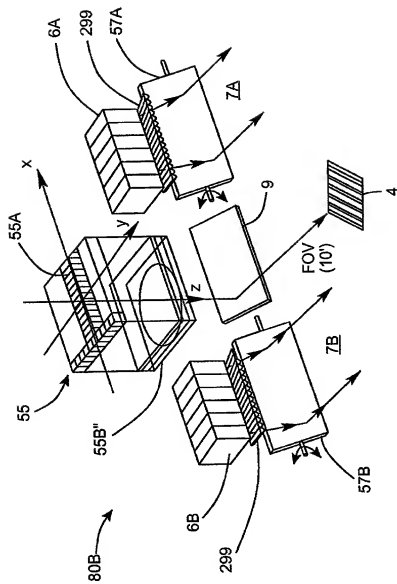


FIG. 6C1

- (1) Variable Focal Length Camera Lens
(2) Variable Focal Distance



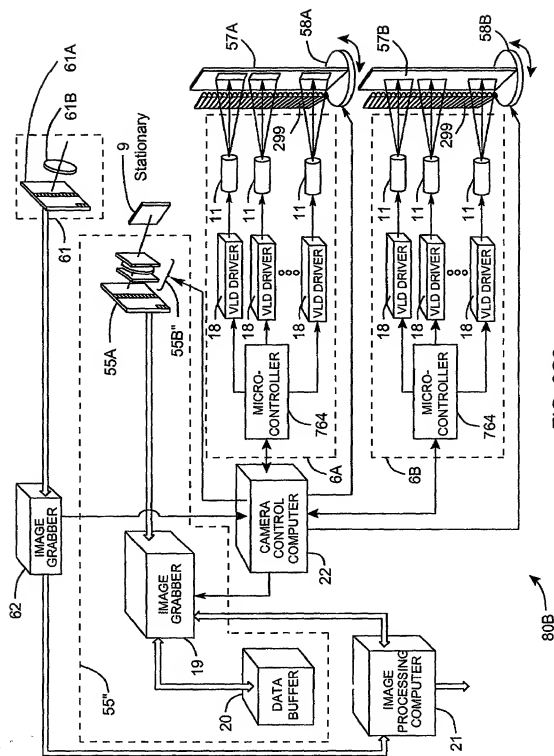


FIG. 6C3

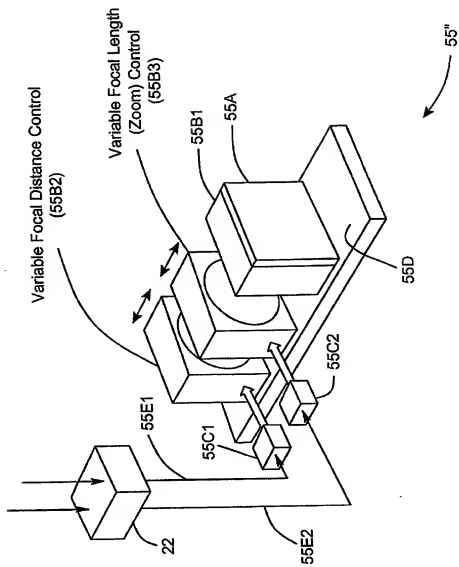


FIG. 6C4

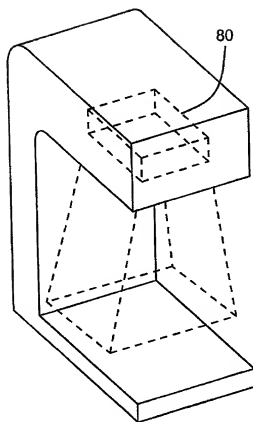


FIG. 6C5

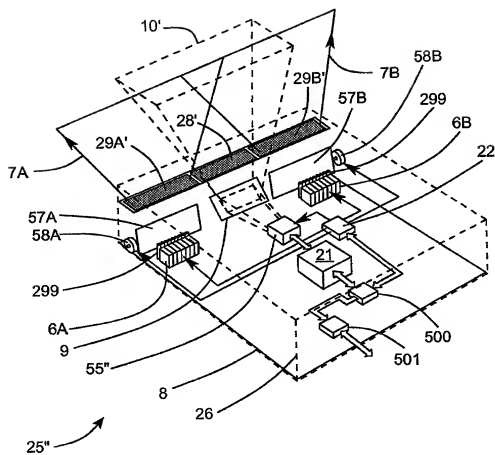


FIG. 6D1

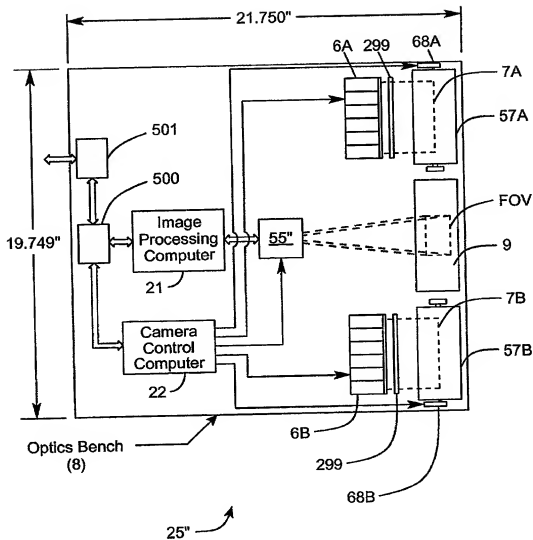


FIG. 6D2

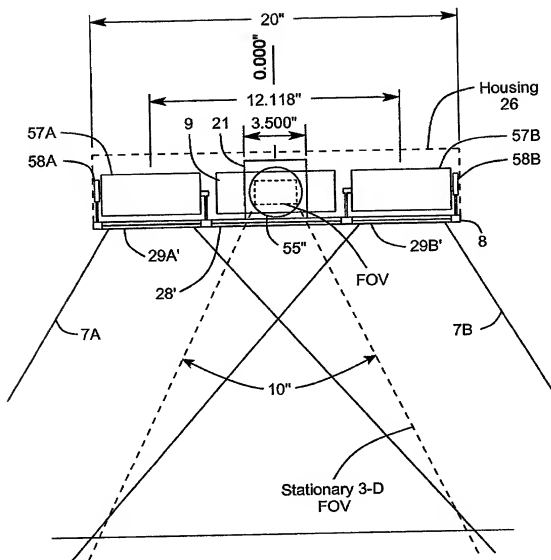


FIG. 6D3

* Variable FOV

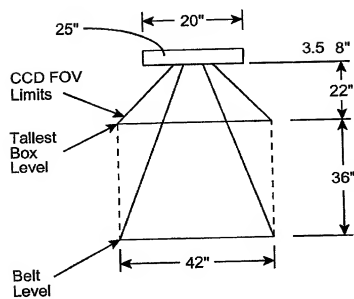


FIG. 6D5

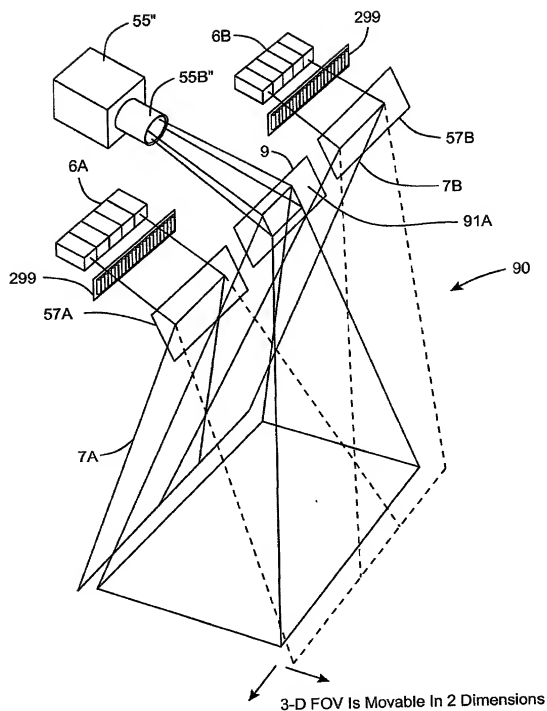
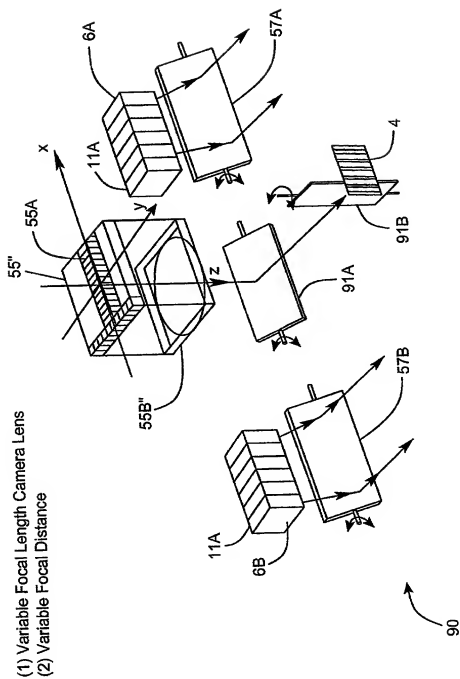


FIG. 6E1



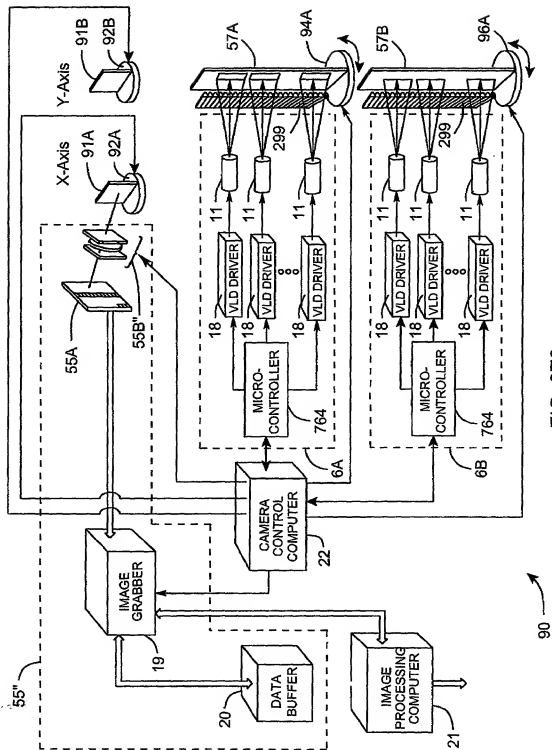


FIG. 6E3

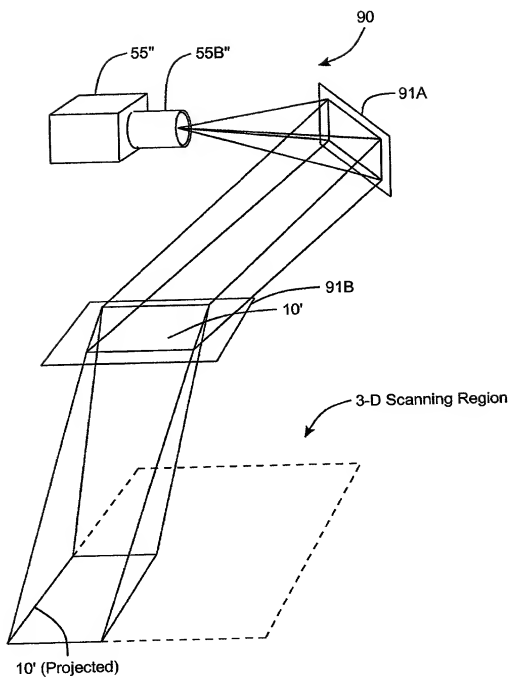


FIG. 6E4

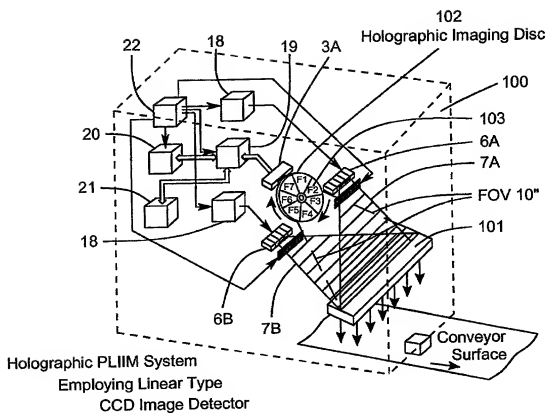


FIG. 7A

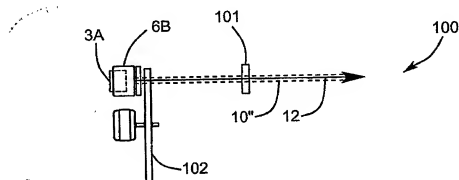


FIG. 7B

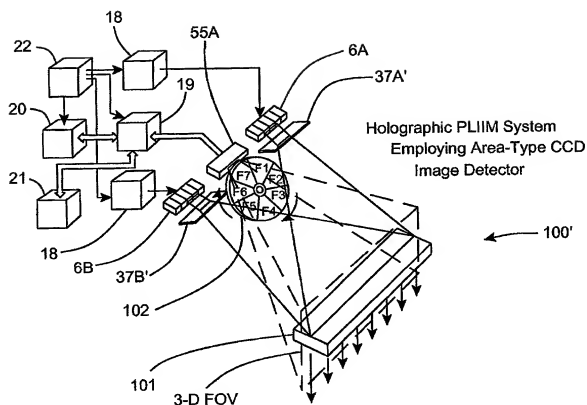


FIG. 8A

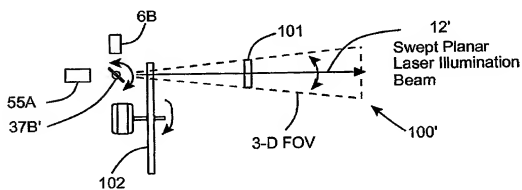


FIG. 8B

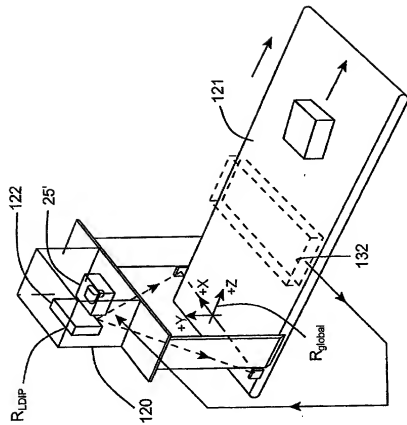
1-D Scanner Embodiment

FIG. 9

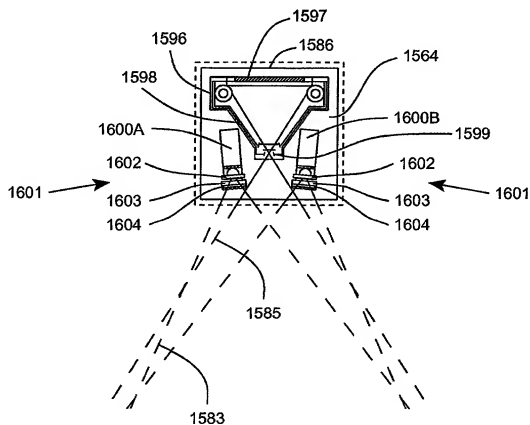


FIG. 43C

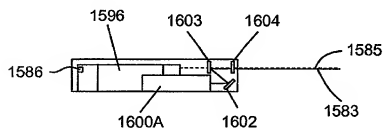


FIG. 43D

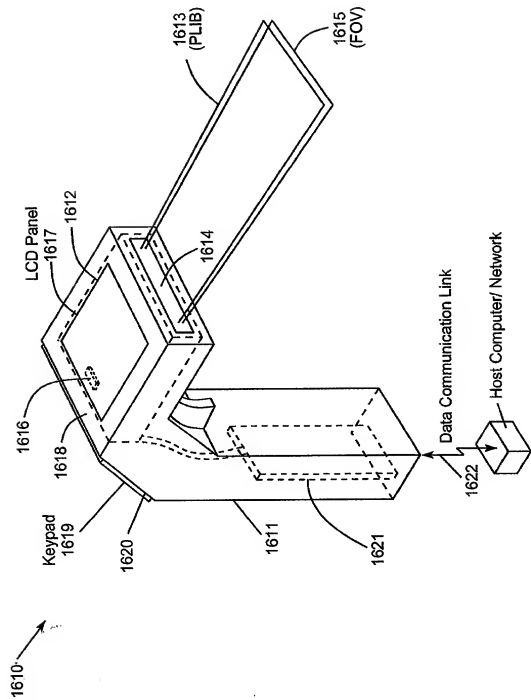


FIG. 44A

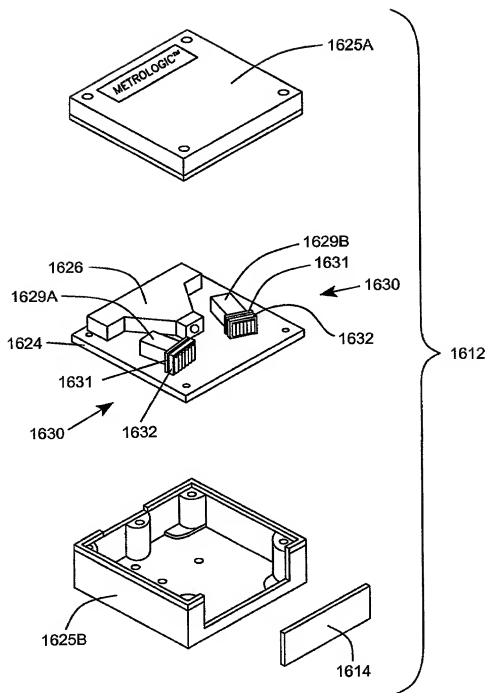


FIG. 44B

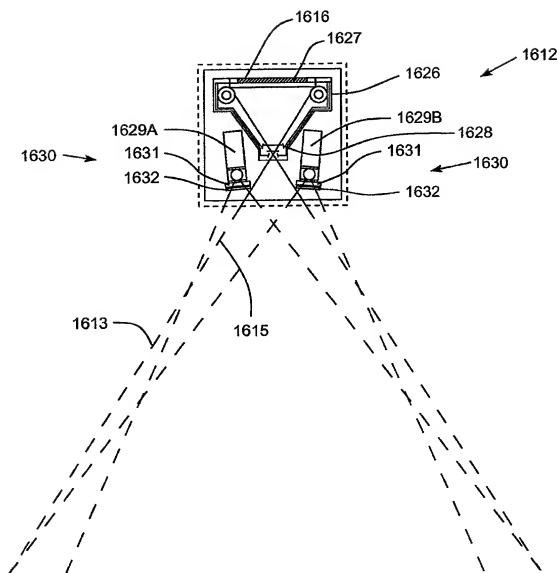


FIG. 44C

1635

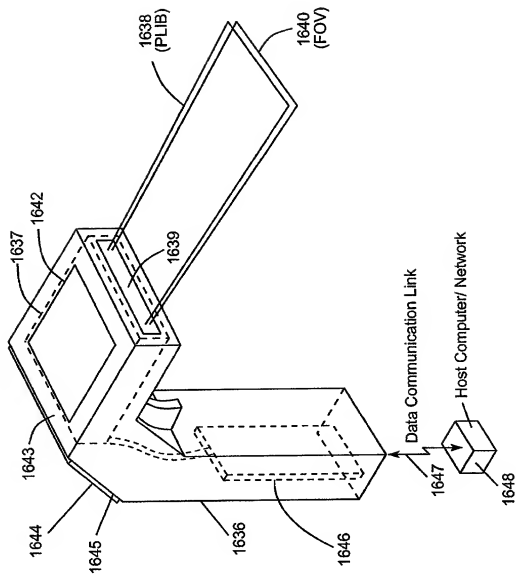


FIG. 45A

1635

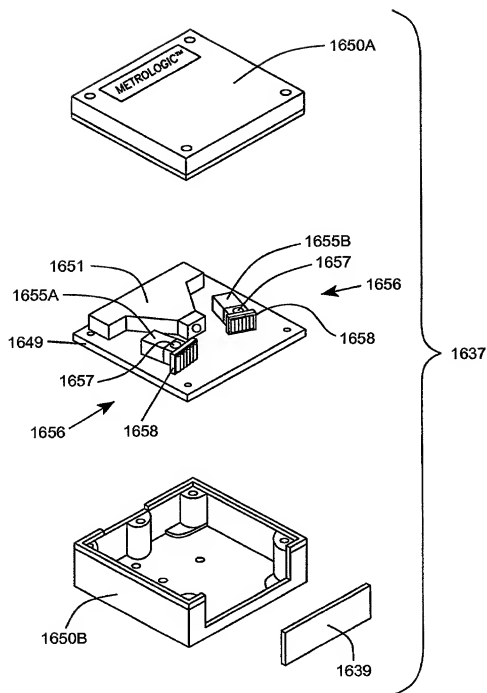


FIG. 45B

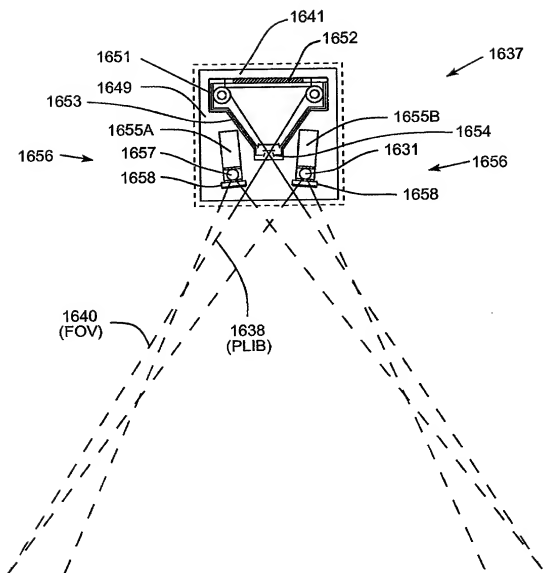


FIG. 45C

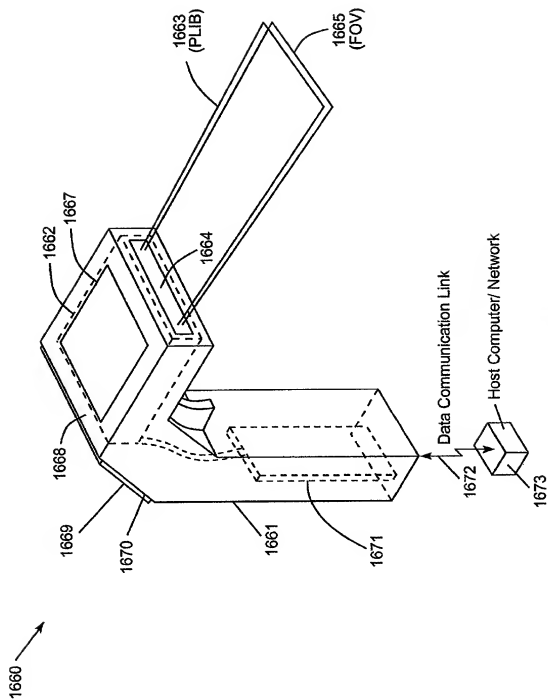


FIG. 46A

201/097

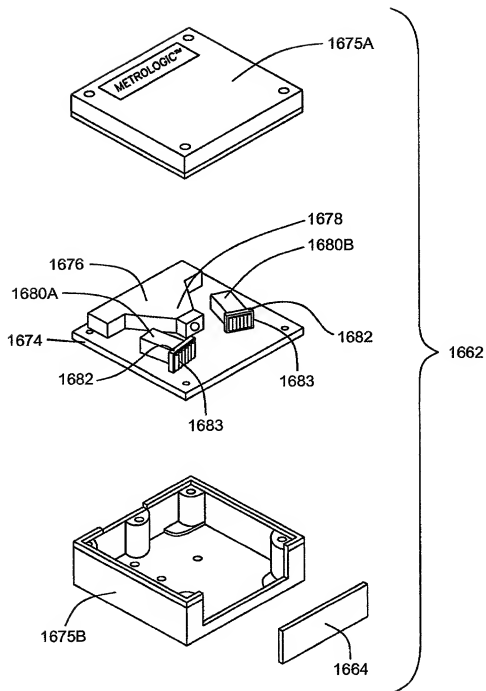


FIG. 46B

202170-65E16001

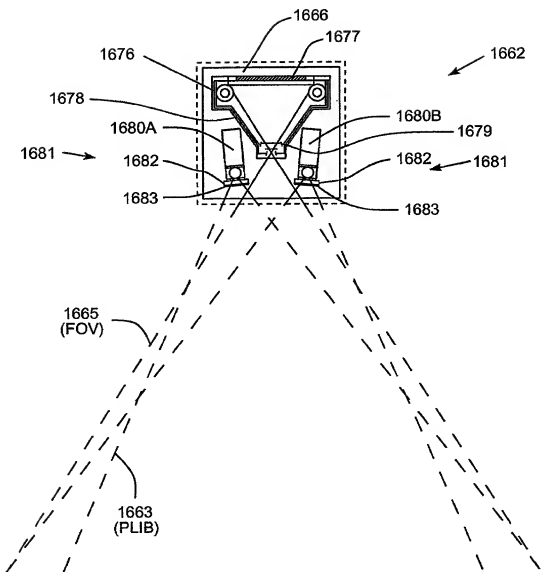


FIG. 46C

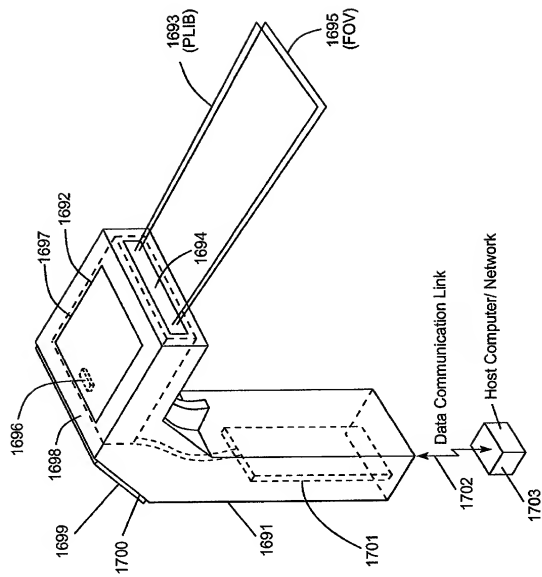


FIG. 47A

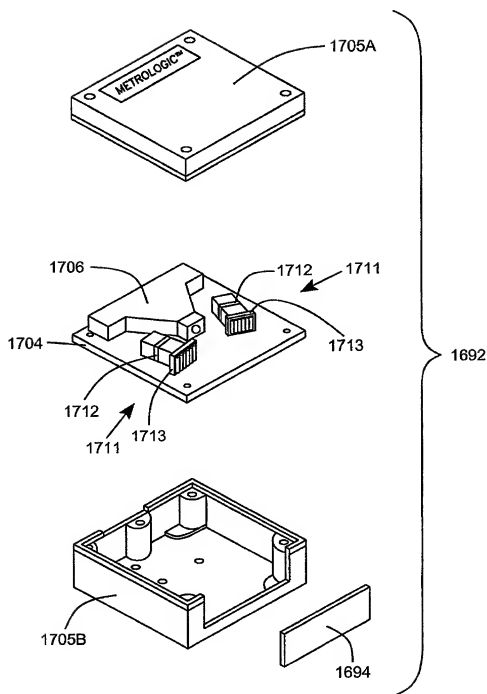


FIG. 47B

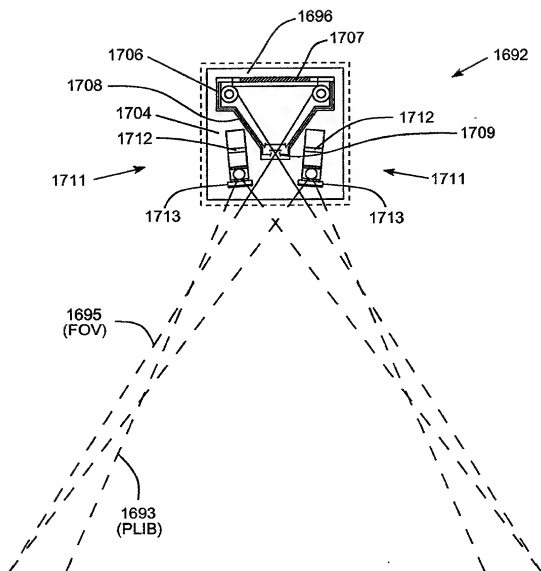


FIG. 47C

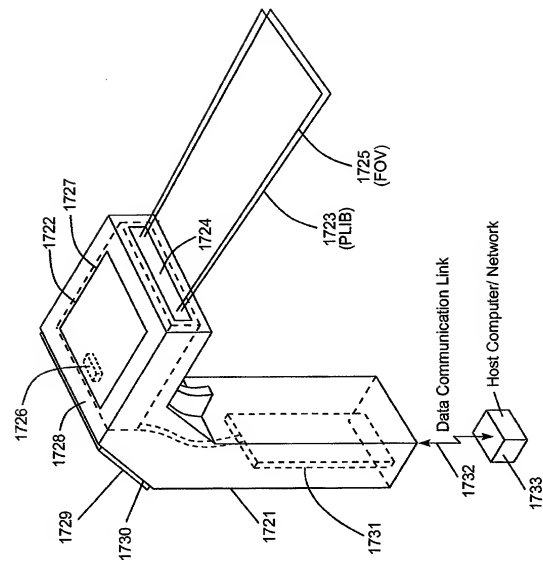


FIG. 48A

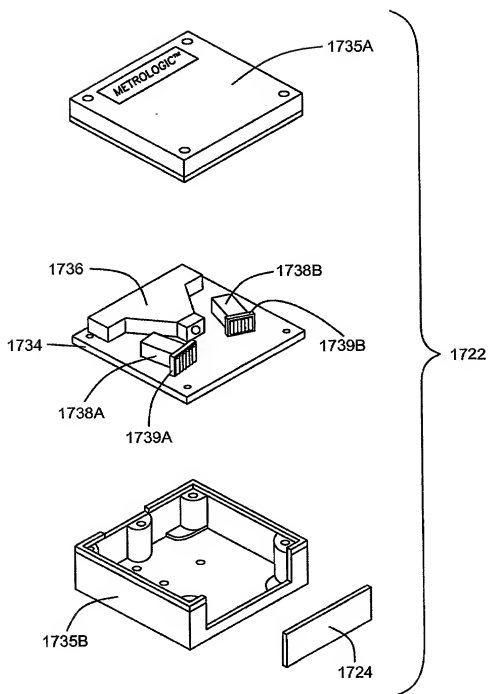


FIG. 48B

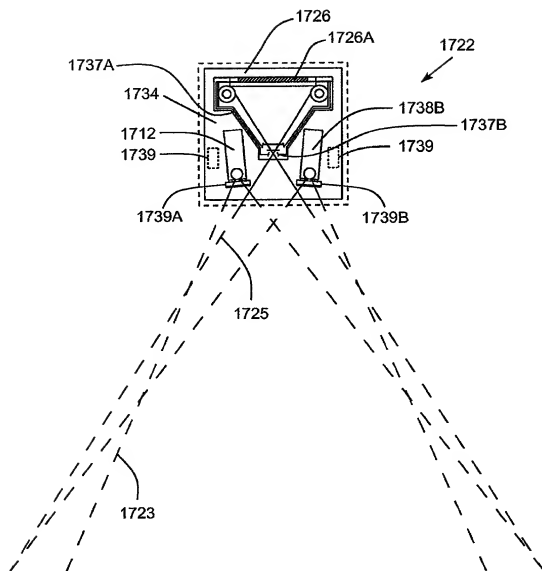


FIG. 48C

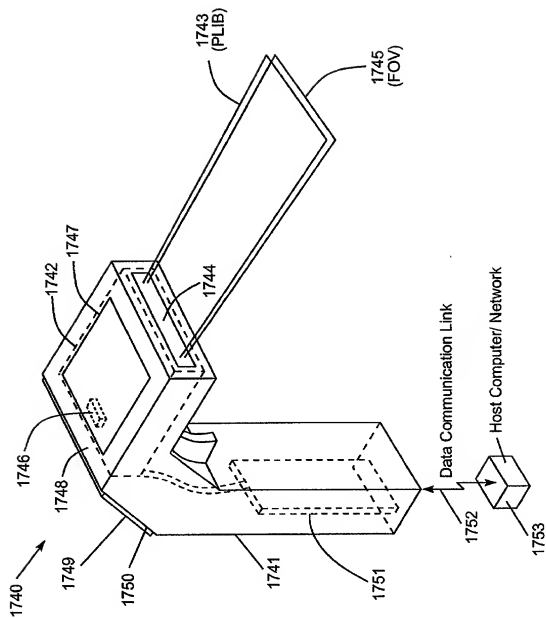


FIG. 49A

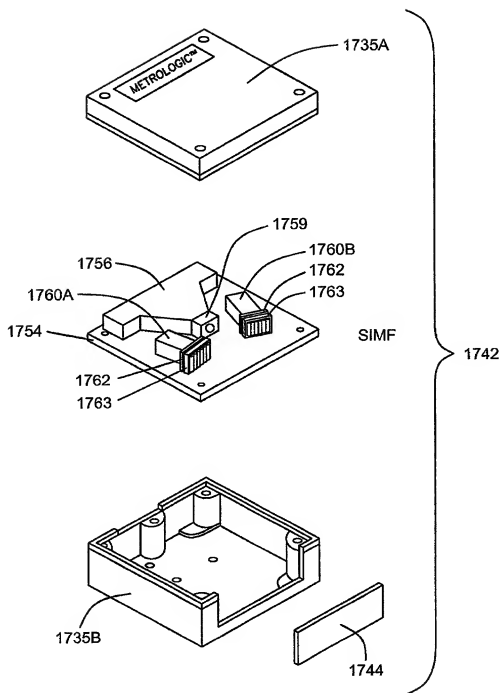


FIG. 49B

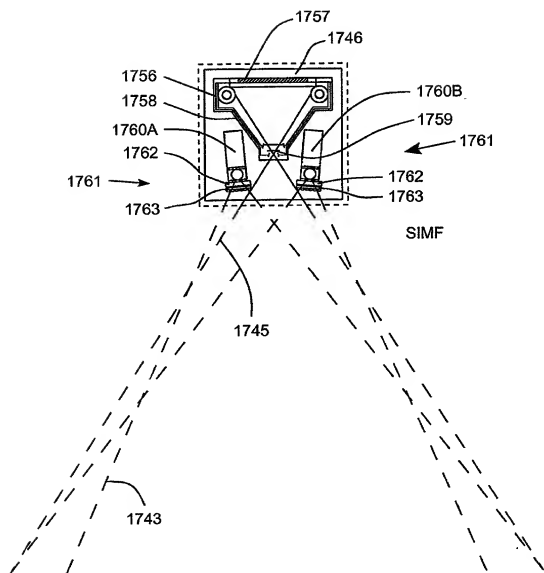


FIG. 49C

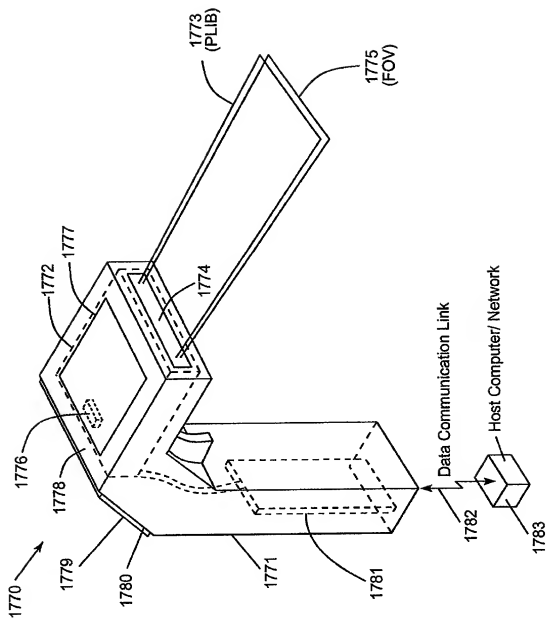


FIG. 50A

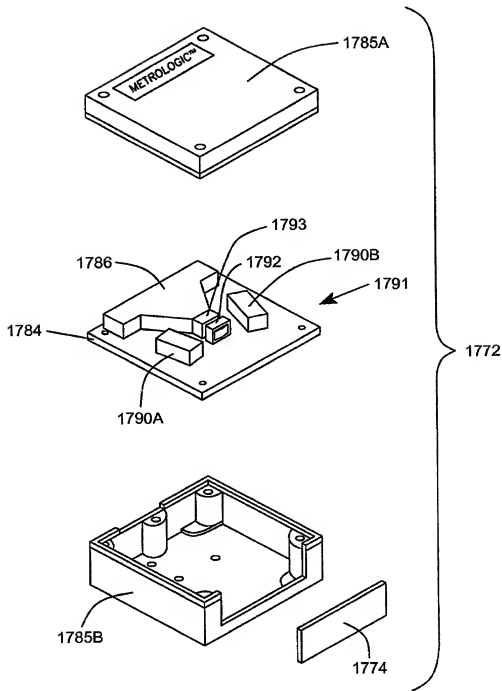


FIG. 50B

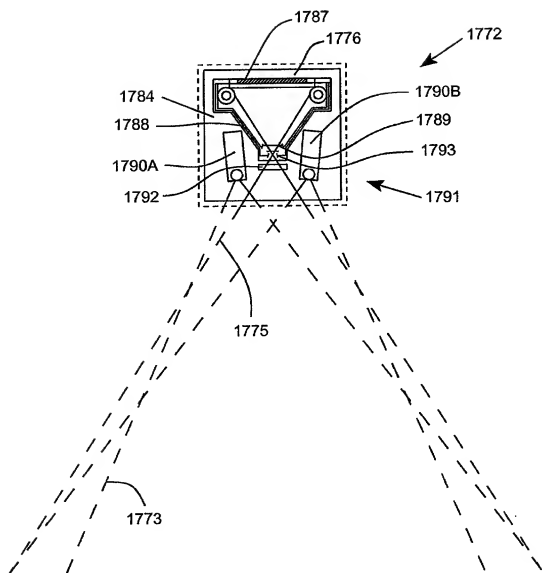


FIG. 50C

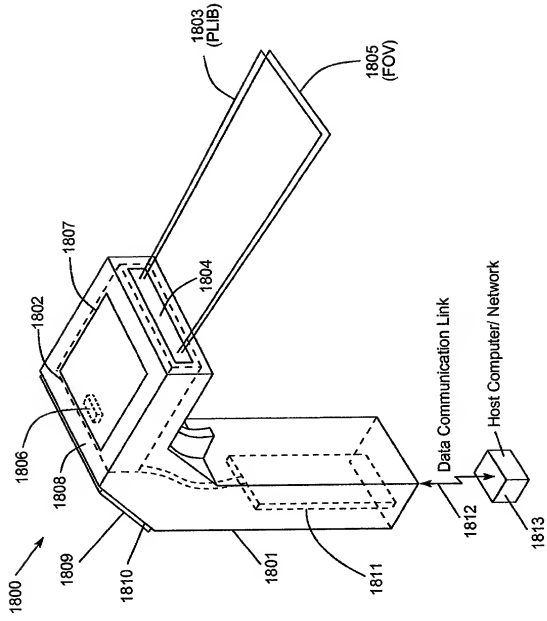
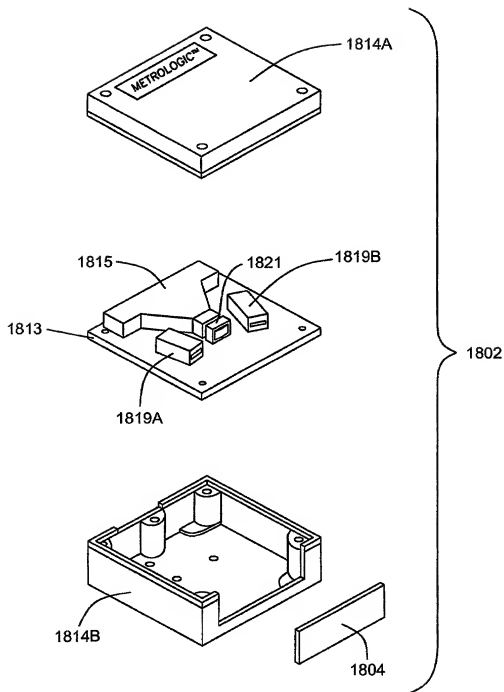


FIG. 51A



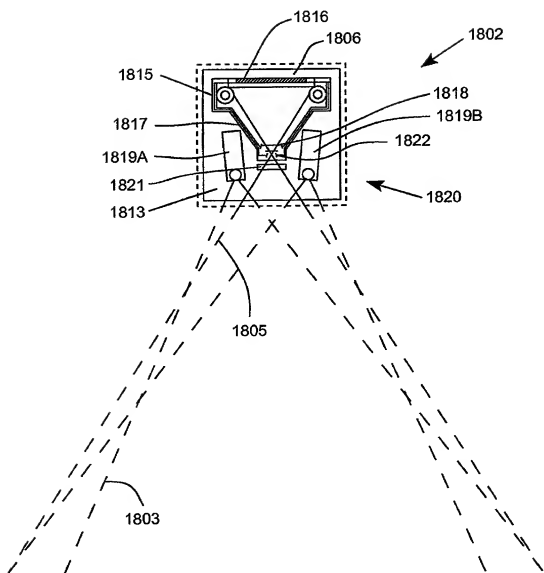


FIG. 51C

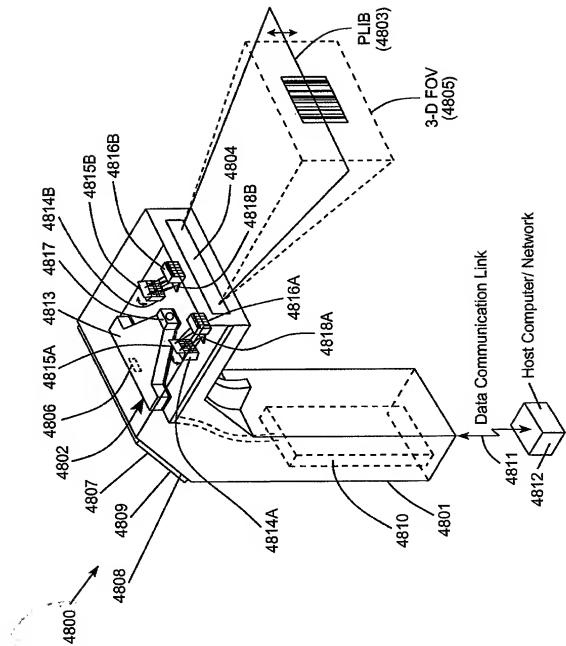


FIG. 52

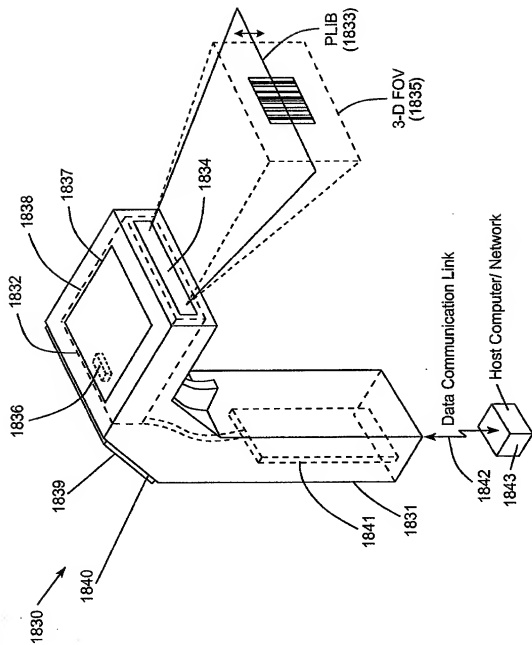


FIG. 52A

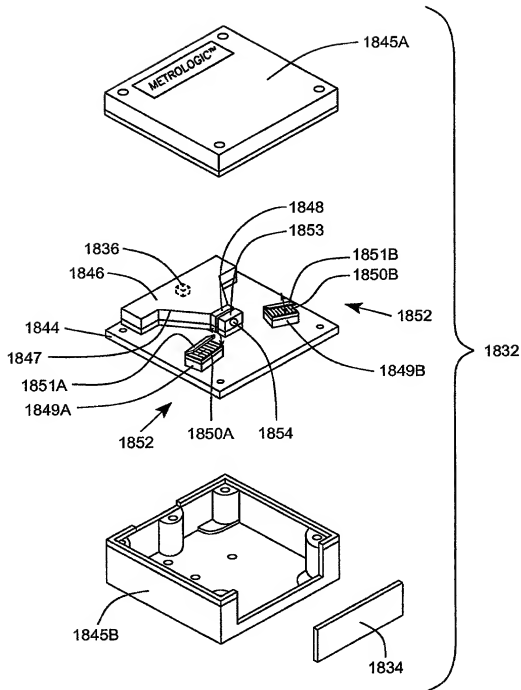


Fig. 113A-3B

FIG. 52B

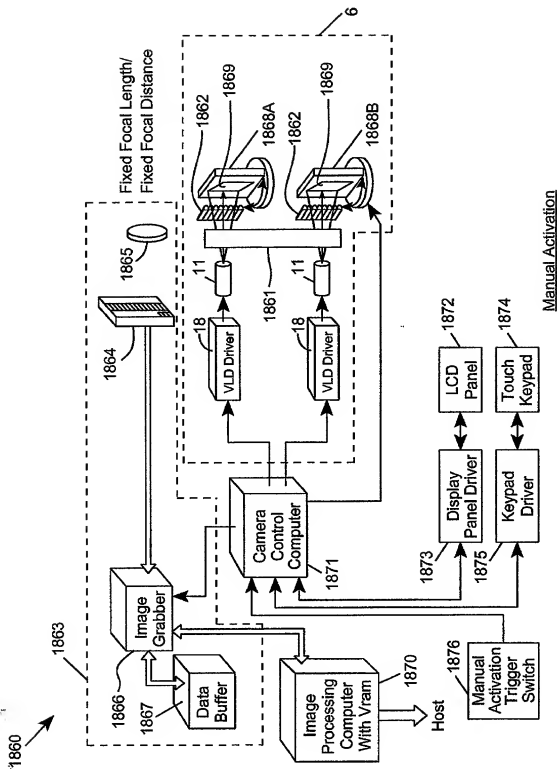


FIG. 53A1

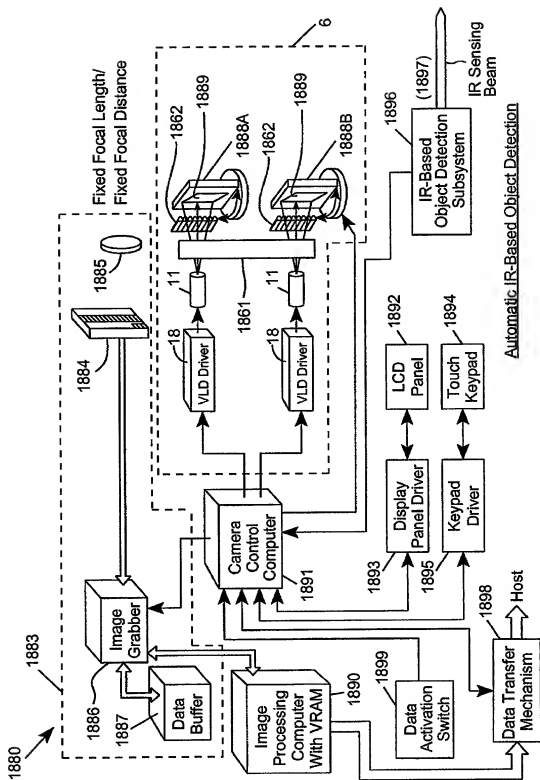
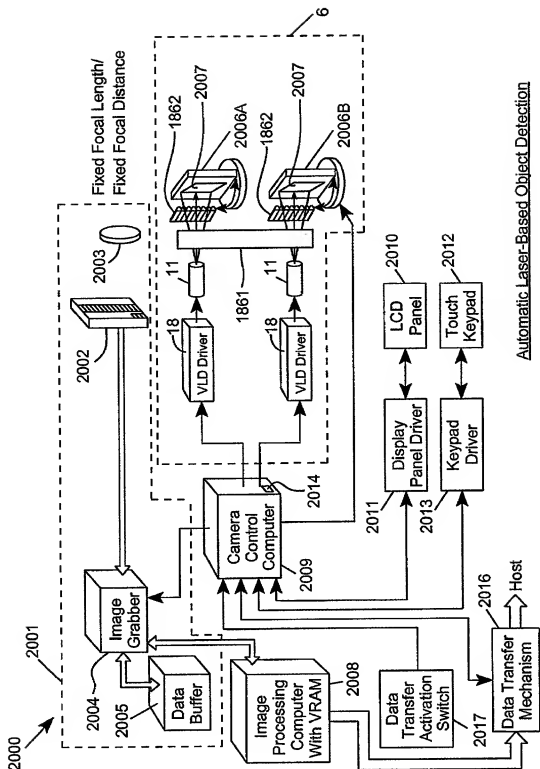


FIG. 53A2



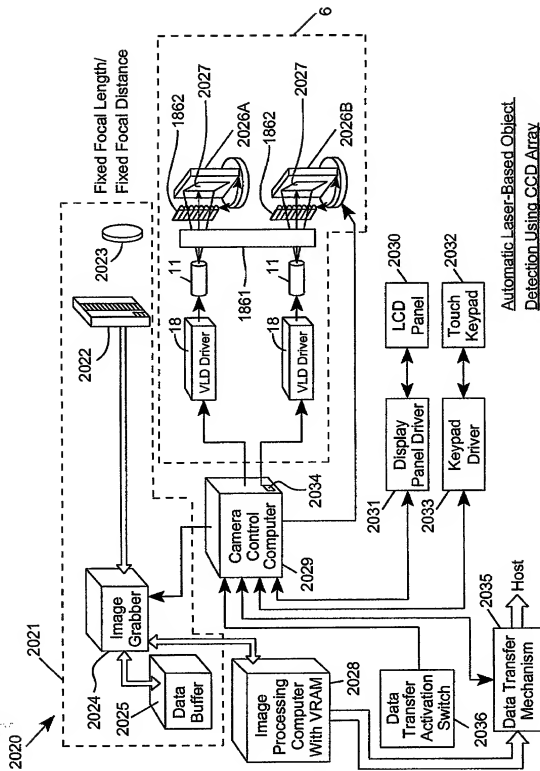


FIG. 53A4

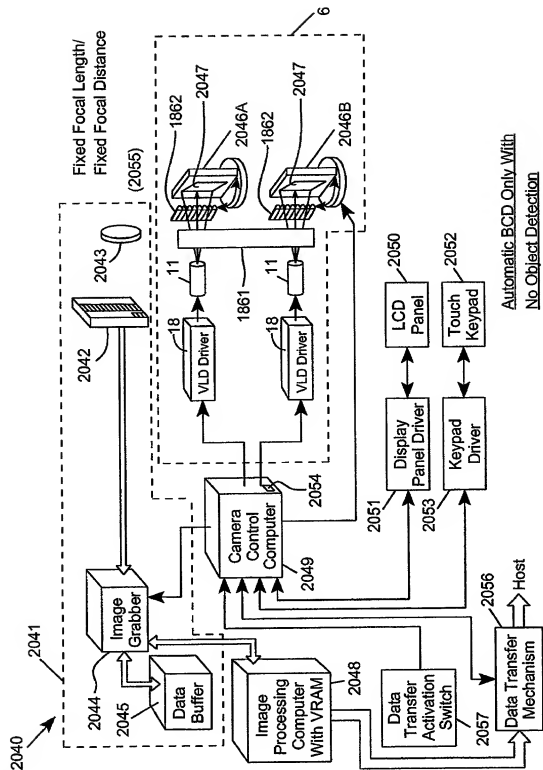


FIG. 53A5

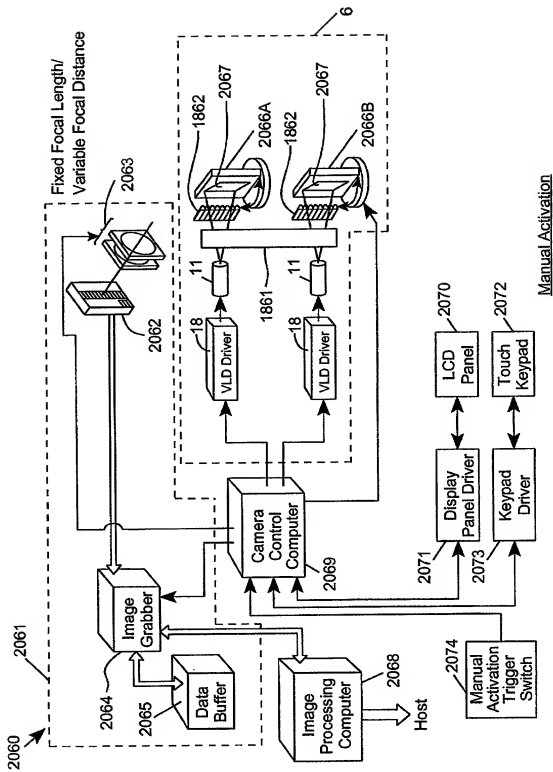


FIG. 53B1

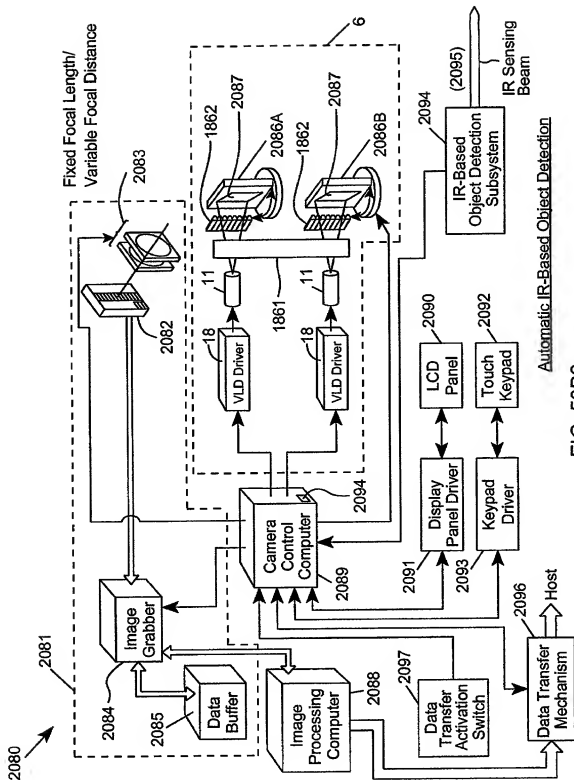
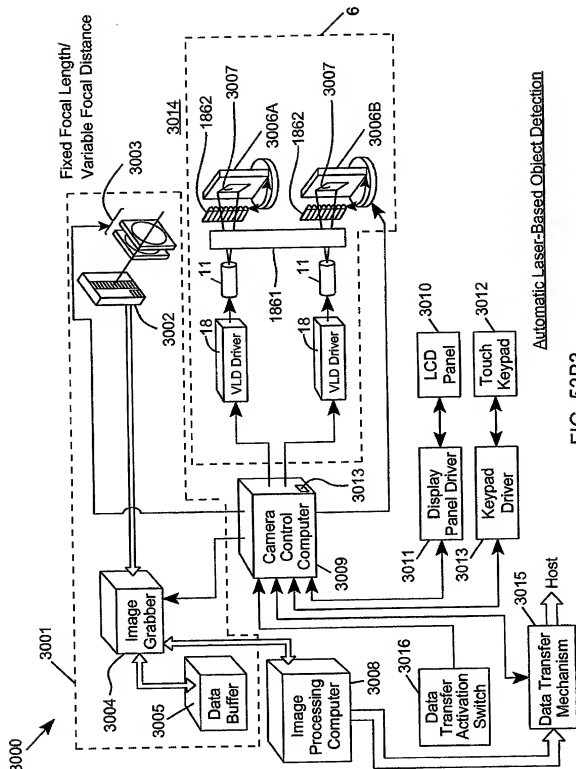


FIG. 53B2



Automatic Laser-Based Object Detection

FIG. 53B3

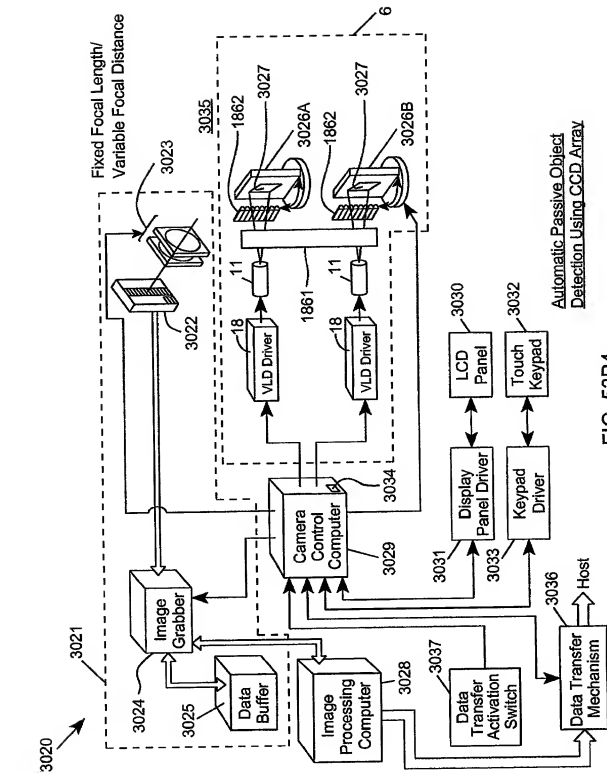
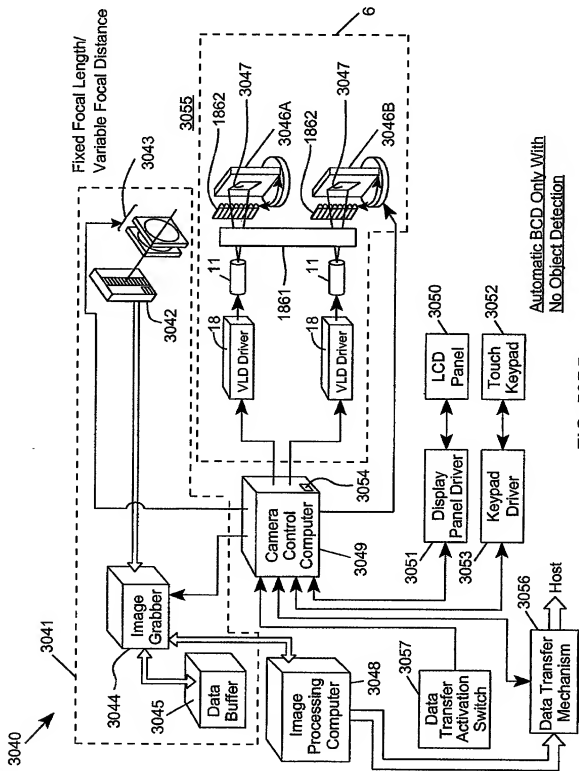


FIG. 53B4



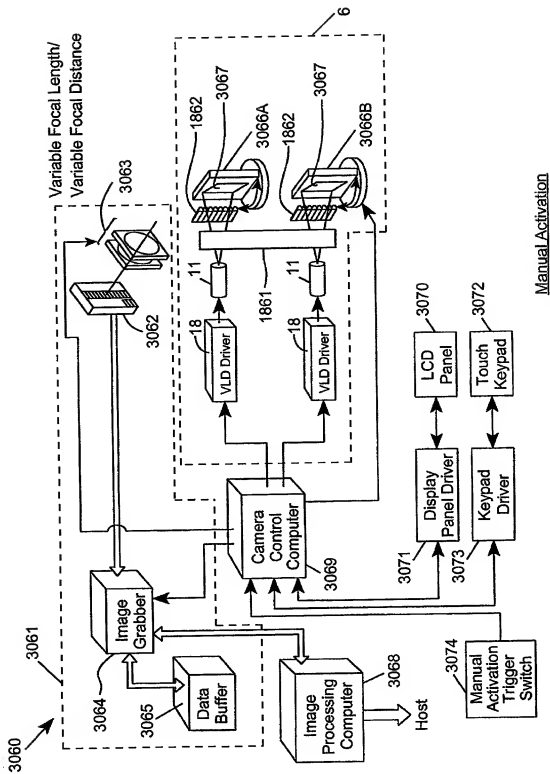


FIG. 53C1

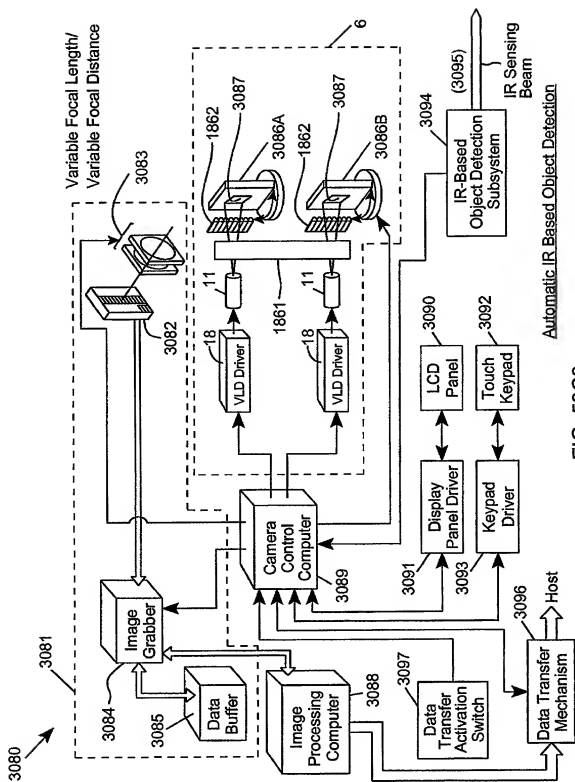
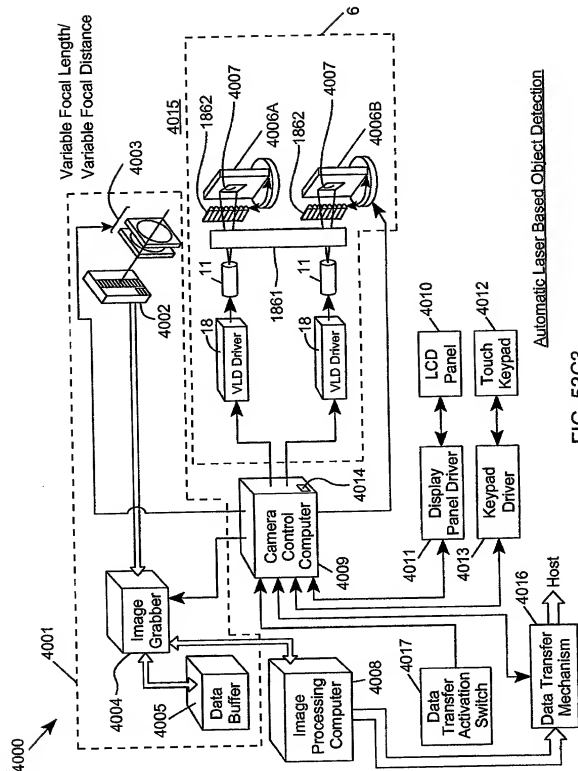


FIG. 53C2



Automatic Laser Based Object Detection

FIG. 53C3

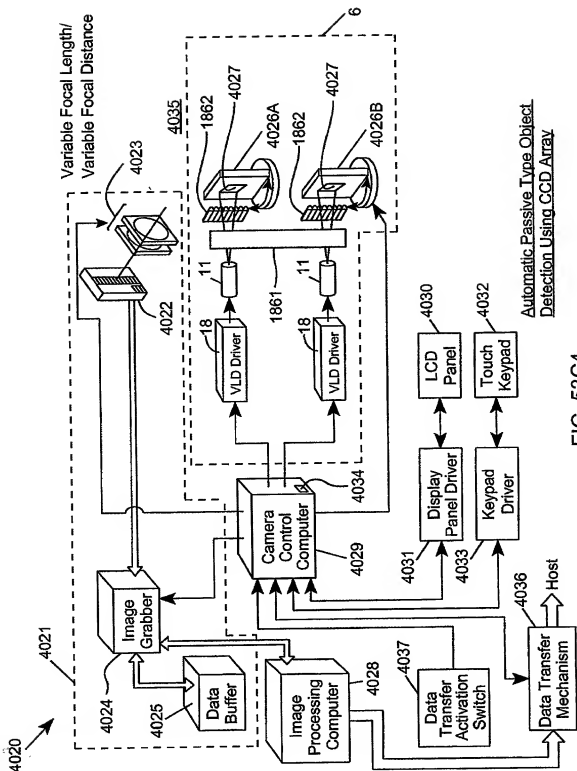
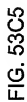


FIG. 53C4



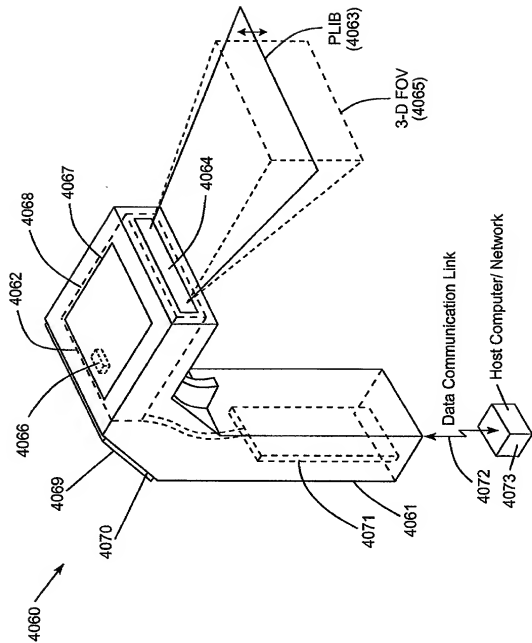


FIG. 54A

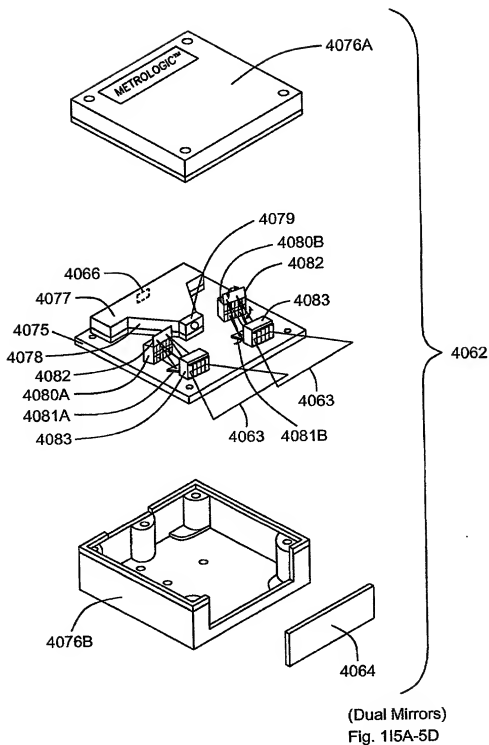


FIG. 54B

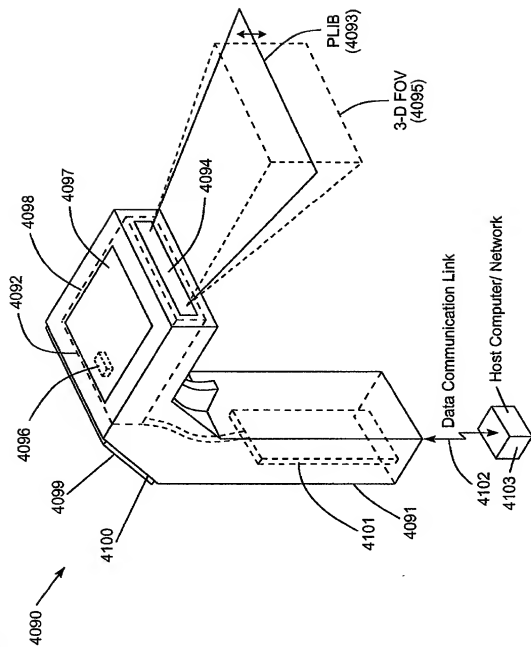


FIG. 55A

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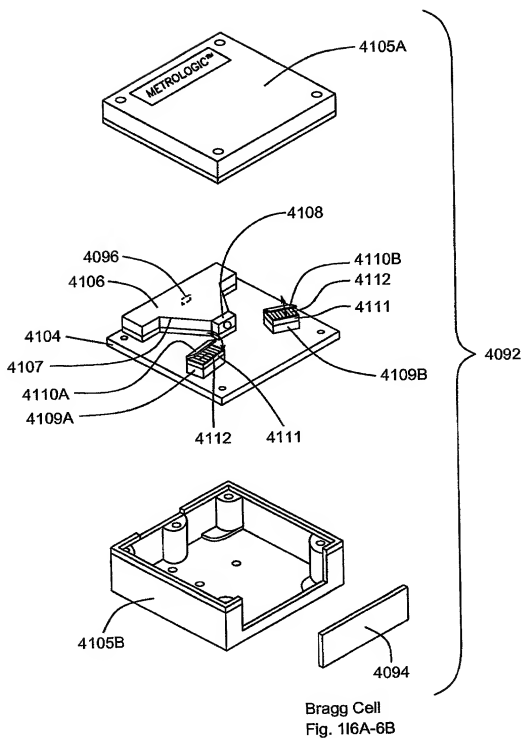
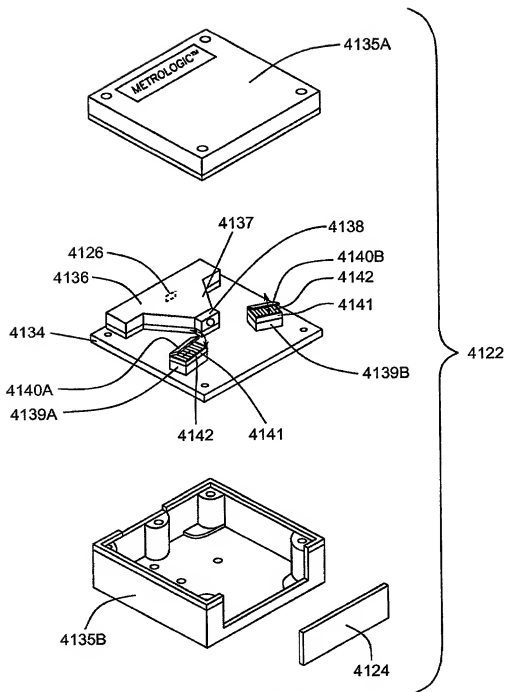


FIG. 55B

202120-66316001



DM
Fig. 117A-7B

FIG. 56B

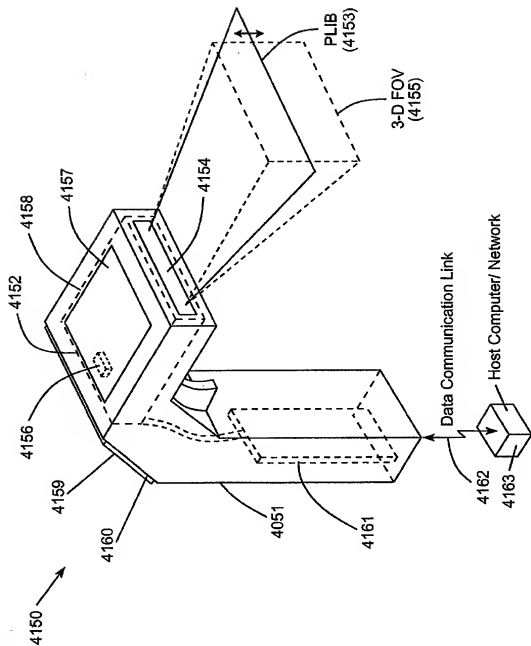


FIG. 57A

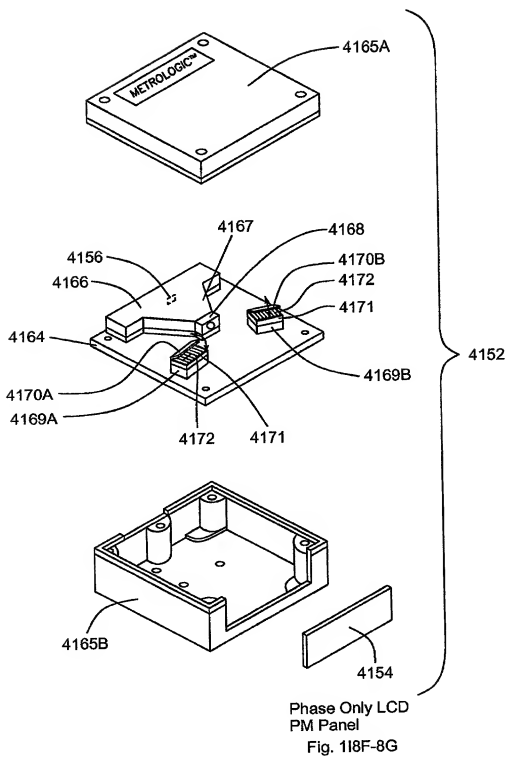


FIG. 57B

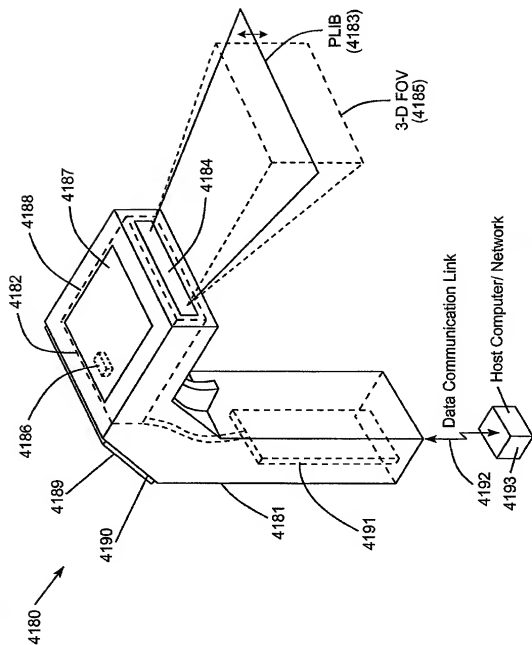
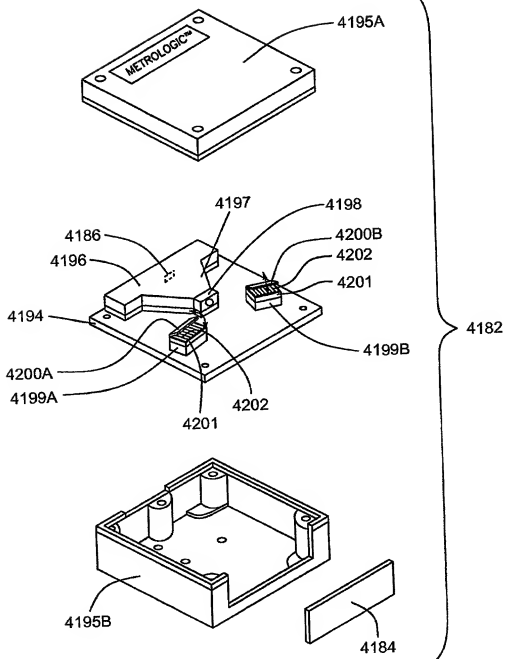


FIG. 58A

00/07/07



HS Optical Shutter
Fig. 1114A-14B

FIG. 58B

202120-66E16001

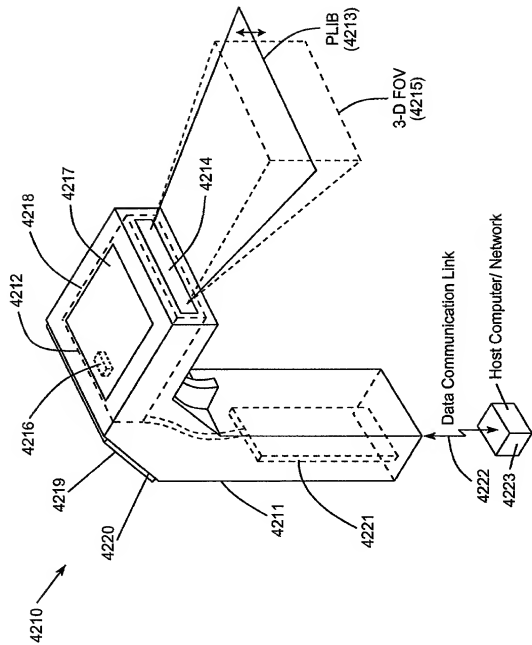
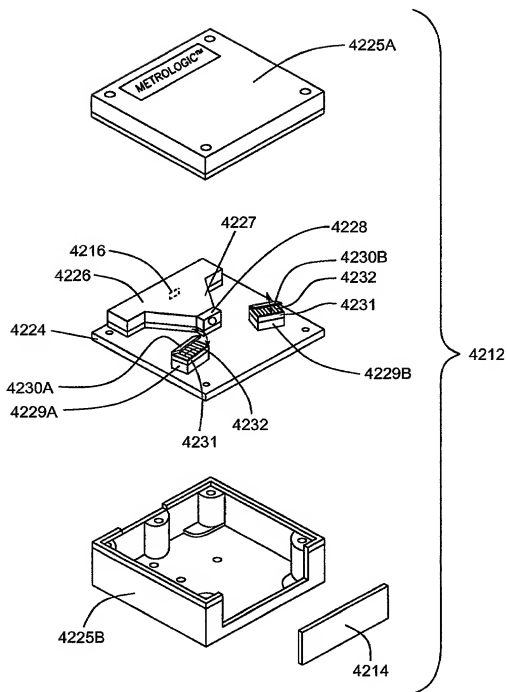


FIG. 59A

11/15/07

10091339-071202



MLLD

Fig. 1115A-15B

FIG. 59B

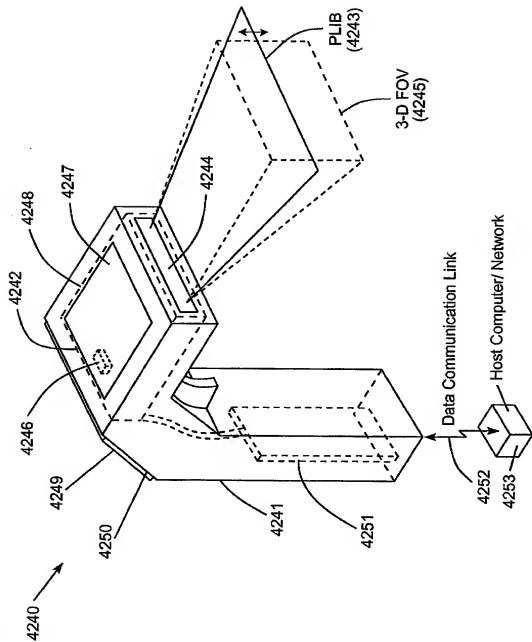
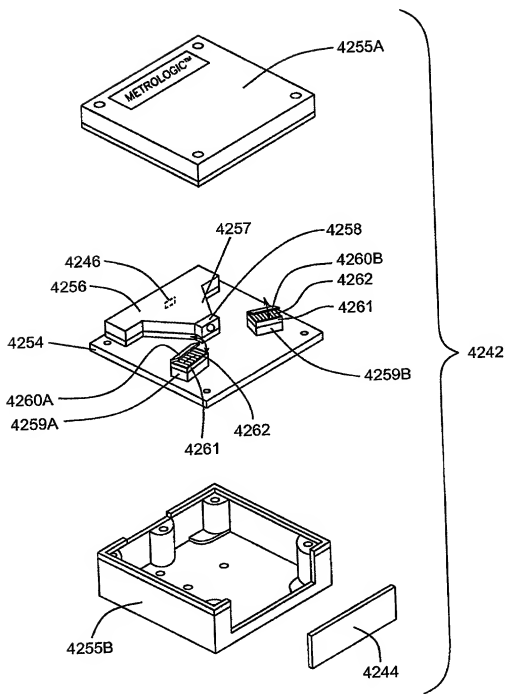


FIG. 60A



Etalon (Temp. Phase Mod.)
Fig. 1117A-17B

FIG. 60B

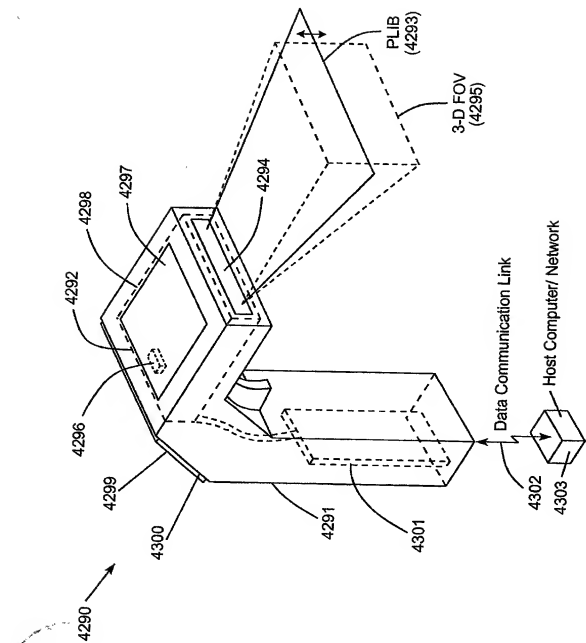
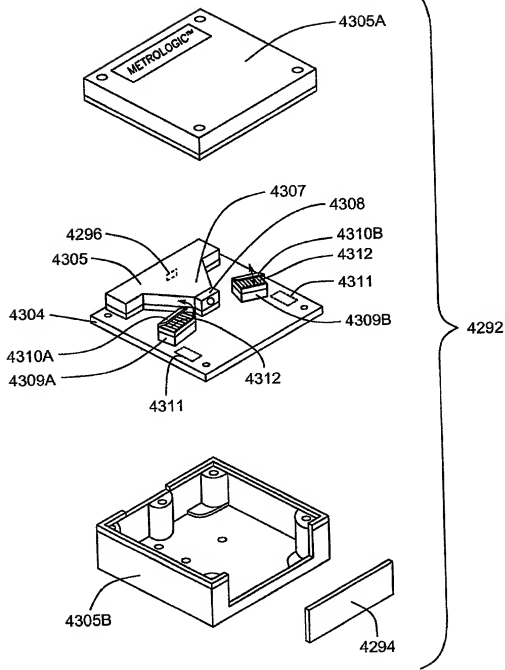


FIG. 61A

007/397



Mode Hopping
Fig. 1119A-19B

FIG. 61B

202120.6EET6001

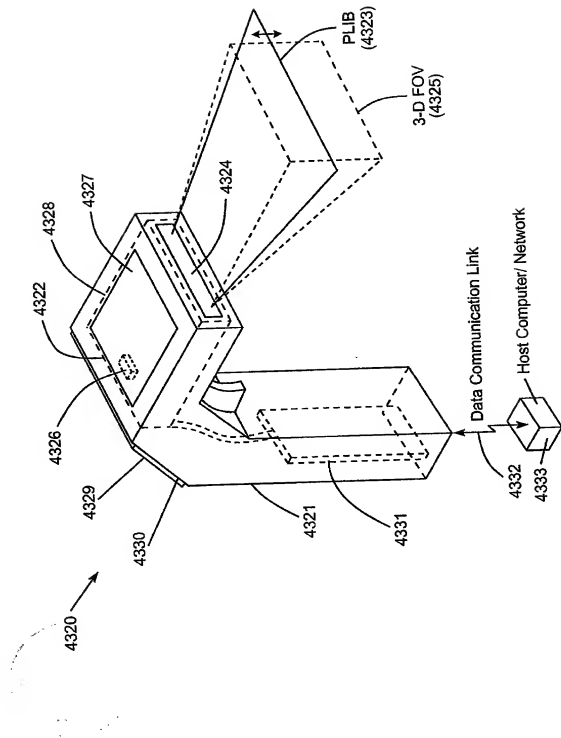
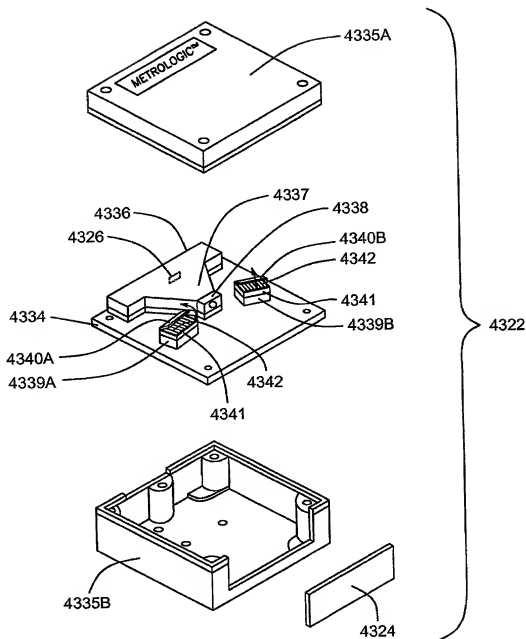


FIG. 62A

501/377



Micro-oscillating
Spatial Intensity
Modulation Panels
Fig. 1121A-21D

FIG. 62B

202120.66E16001

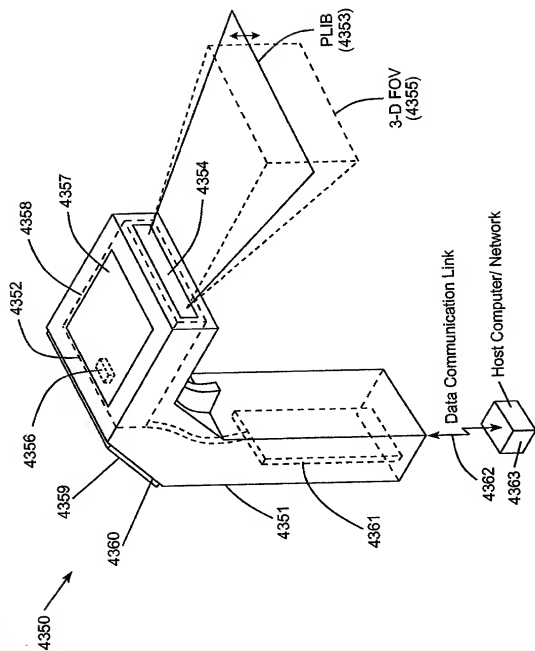
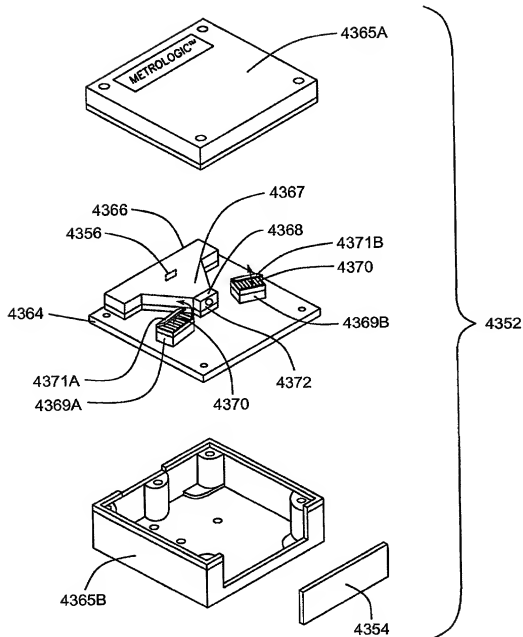


FIG. 63A



EO or Mechanically
Rotating Iris

Fig. 1123A-23B

FIG. 63B

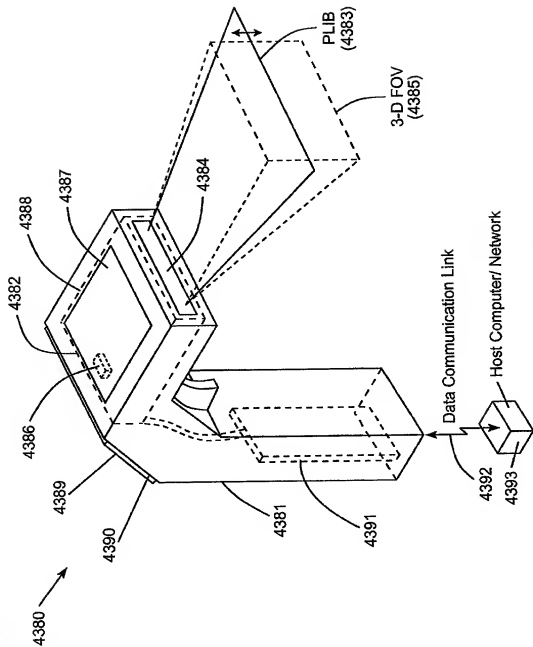
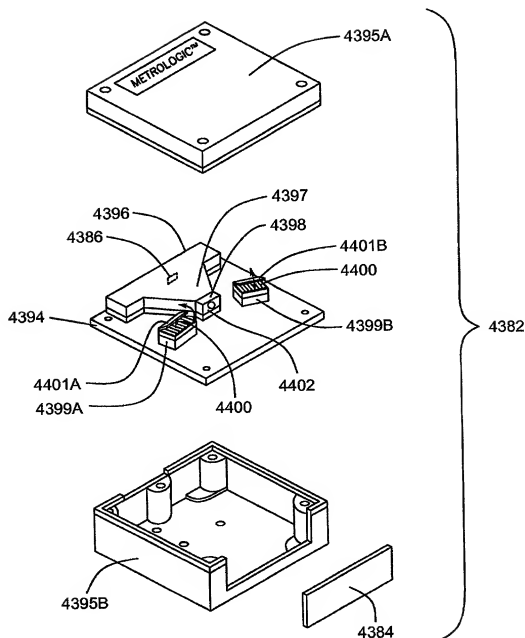


FIG. 64A



E-optical Shutter
Before IFD Lens
Fig. 1124A

FIG. 64B

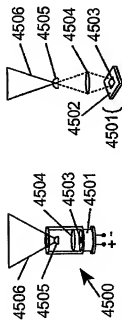


FIG. 65A

FIG. 65B

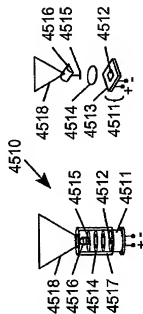


FIG. 66A

FIG. 66B

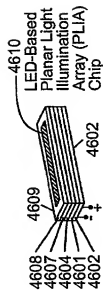


FIG. 67A

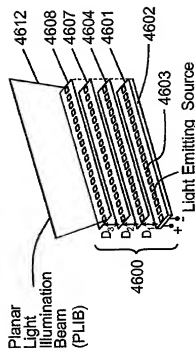


FIG. 67B

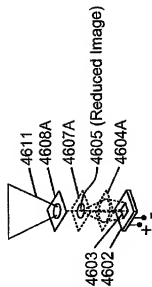


FIG. 67C

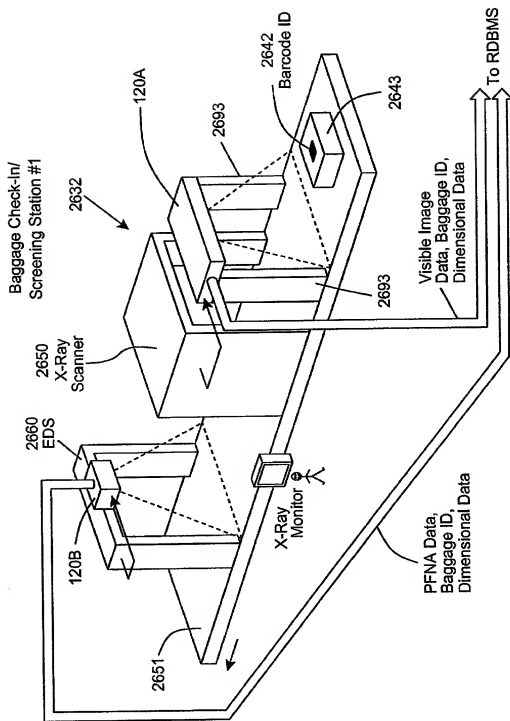
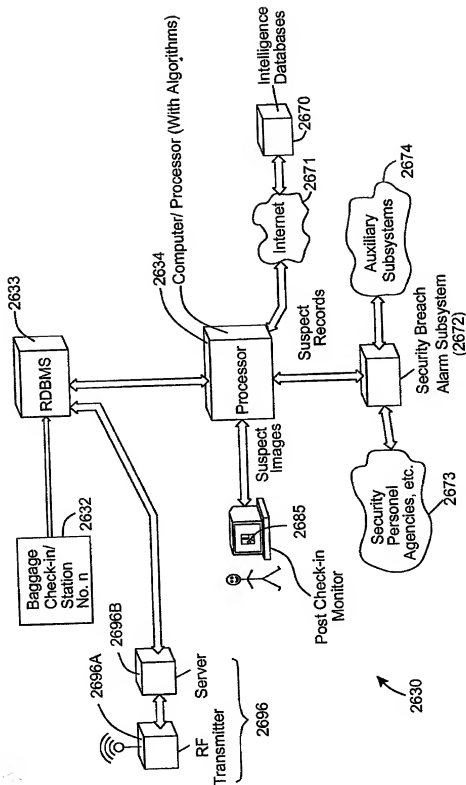


FIG. 68-1



"Airport Security System"

FIG. 68-2

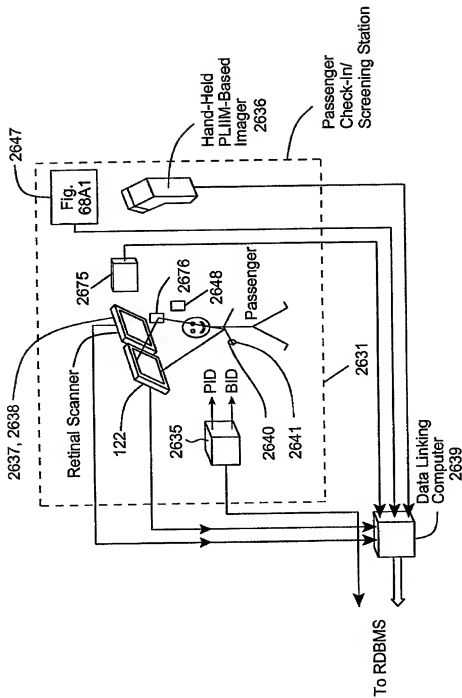
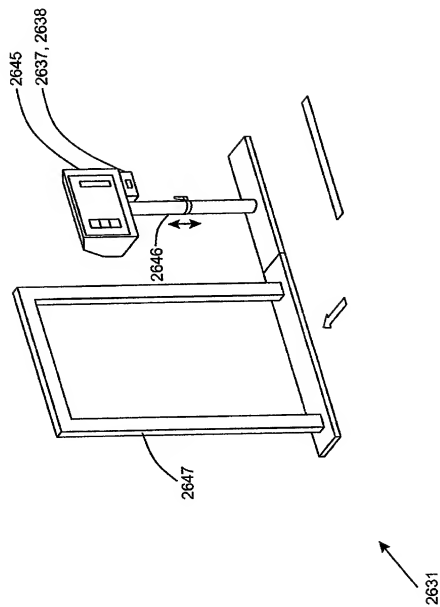
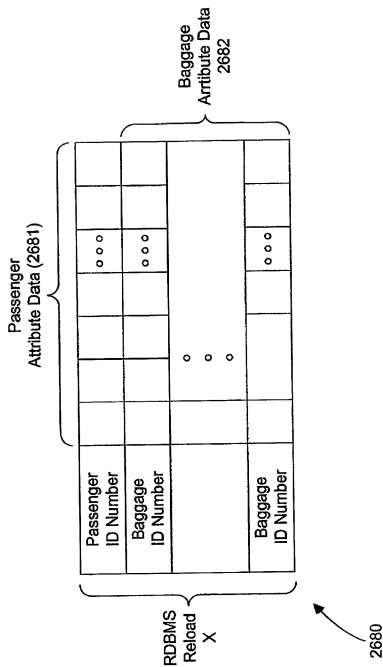


FIG. 68-3





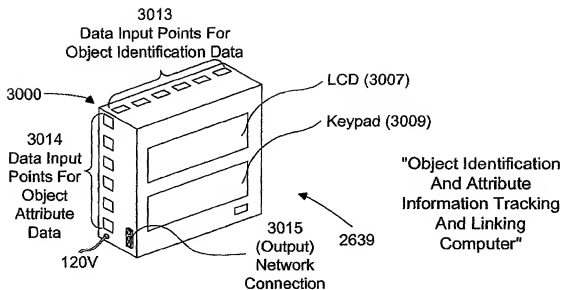


FIG. 68C1

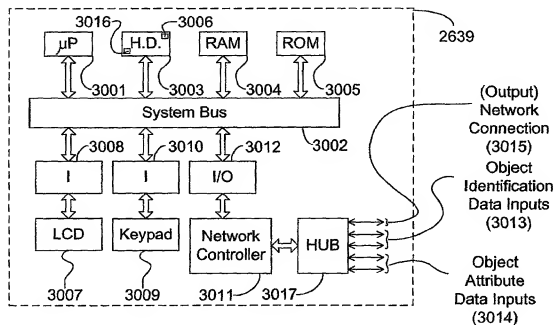


FIG. 68C2

10091339.071202

Object Identification And Attribute Information Tracking And Linking Computer System

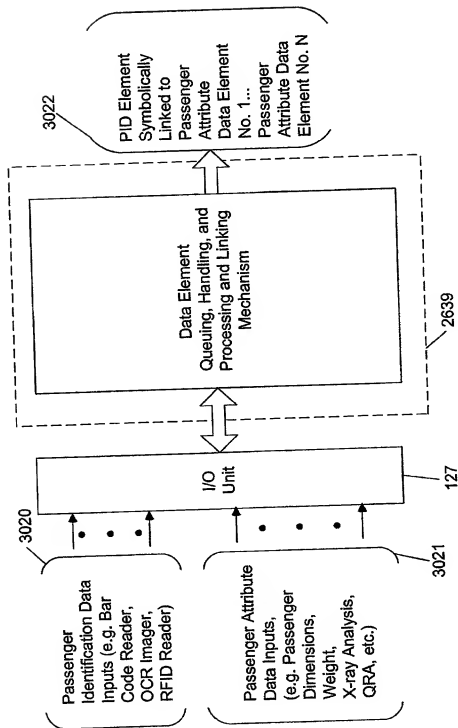


FIG. 68C3

Data Element Queuing, Handling, And Processing Subsystem Employed In The Object Identification
And Attribute Acquisition System Of The Present Invention. (131)

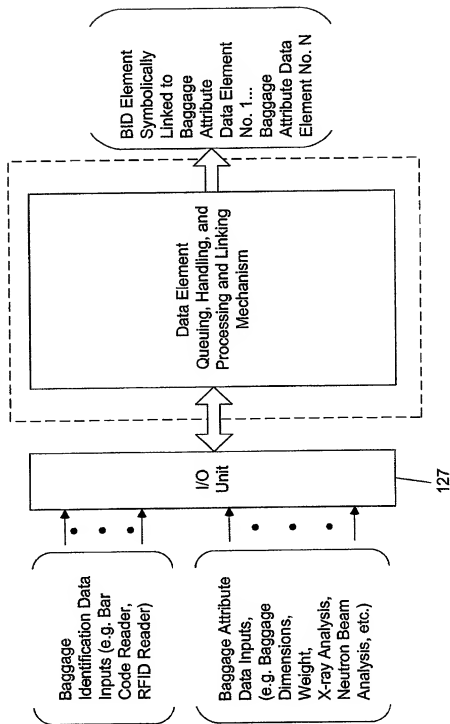


FIG. 68C4

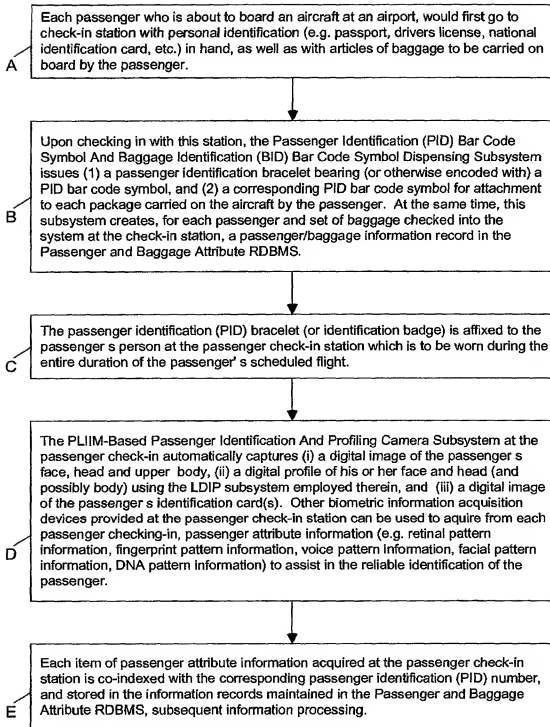


FIG. 68D1

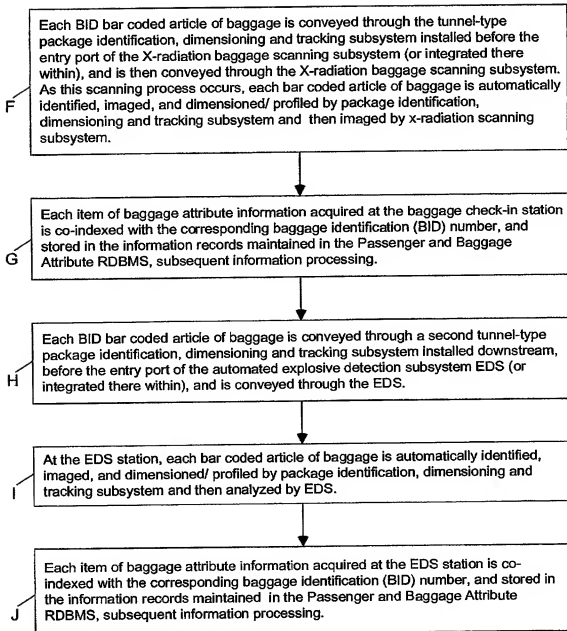


FIG. 68D2

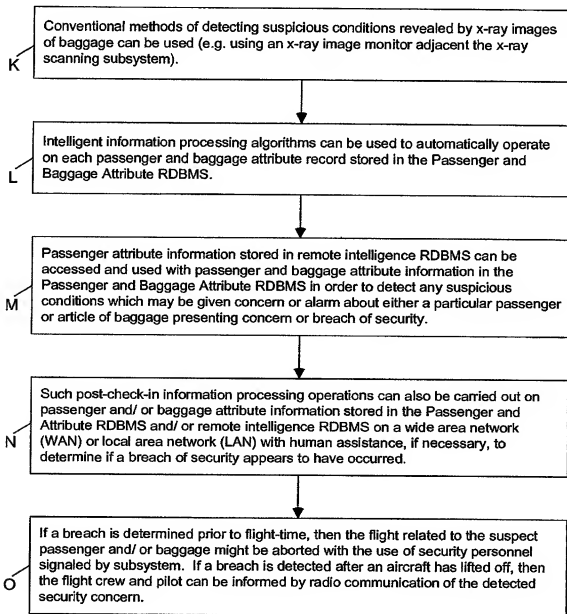


FIG. 68D3

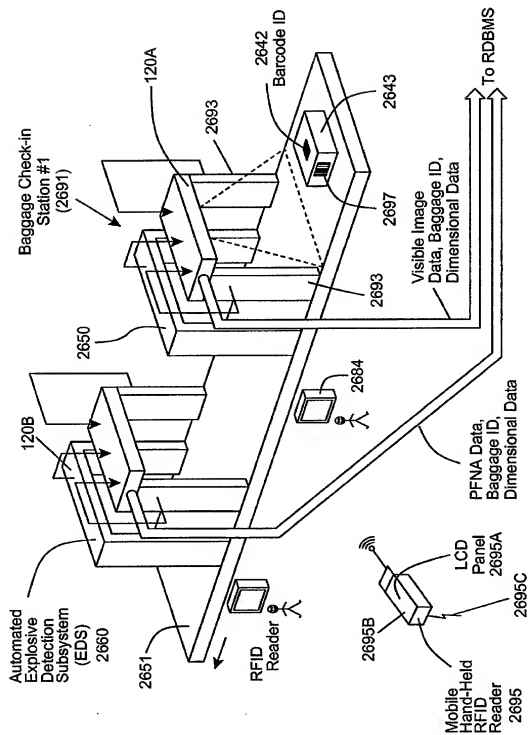


FIG. 69-1

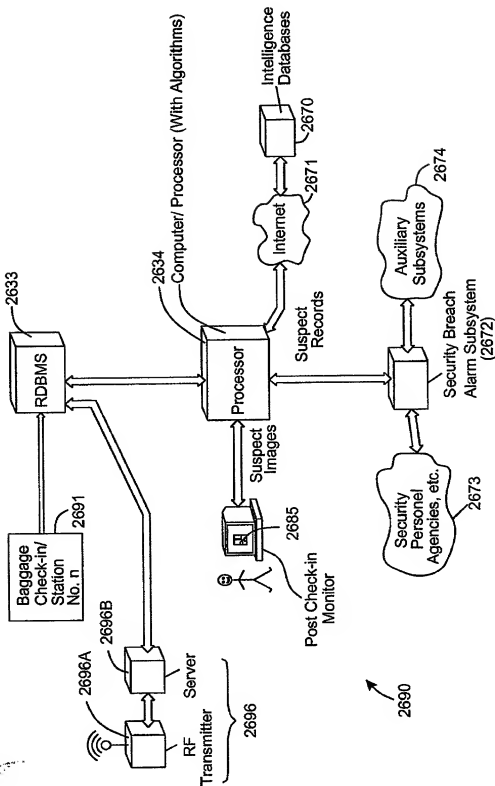


FIG. 69-2

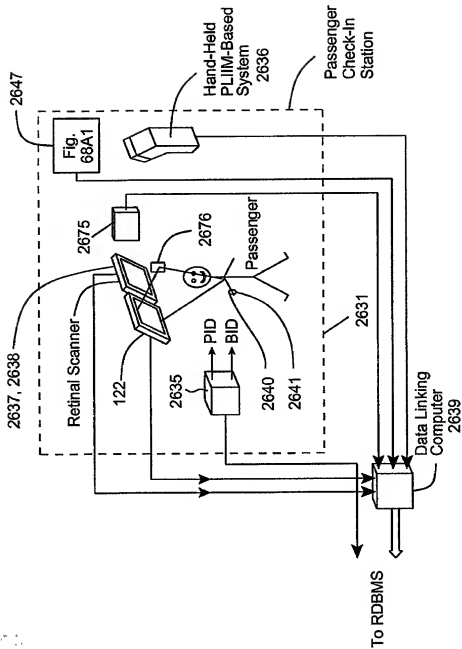


FIG. 69-3

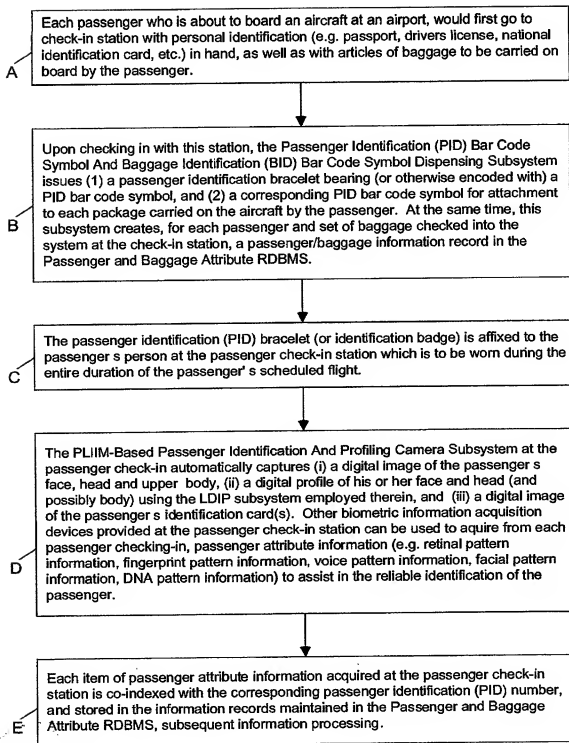


FIG. 69B1

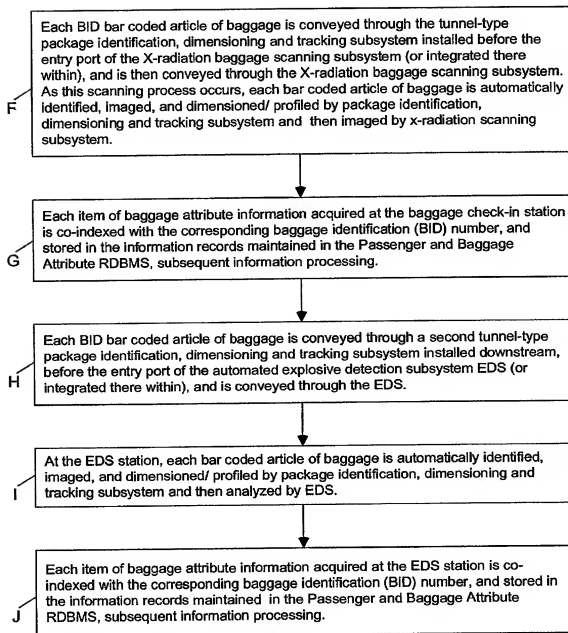


FIG. 69B2

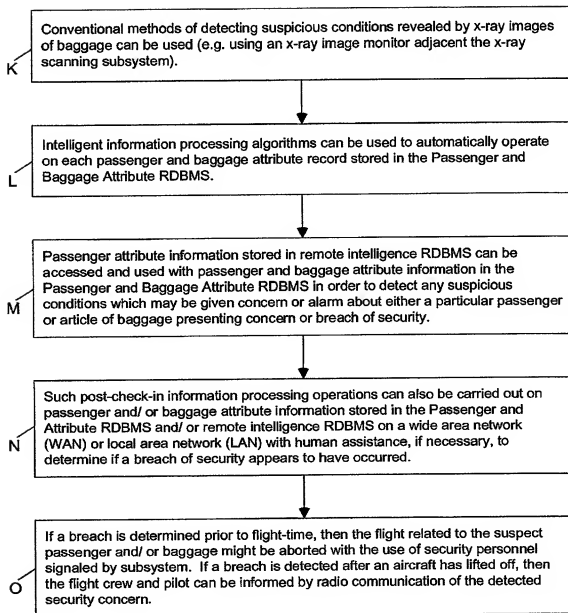


FIG. 69B3

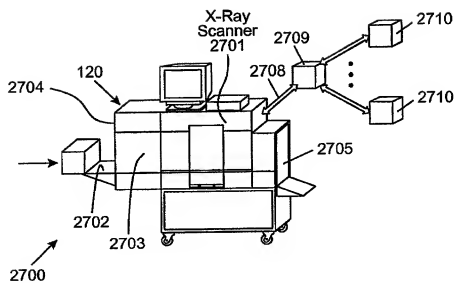


FIG. 70A

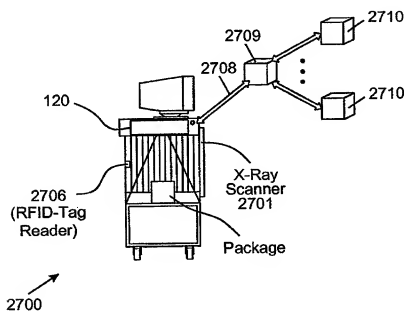


FIG. 70B

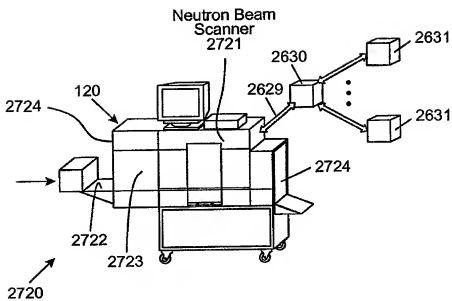


FIG. 71A

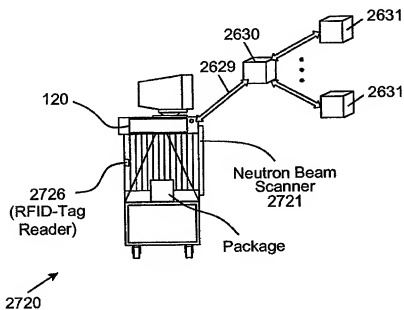


FIG. 71B

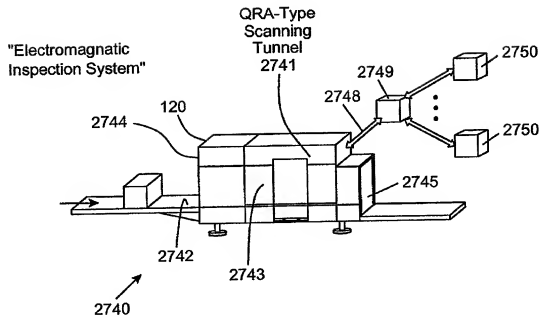


FIG. 72A

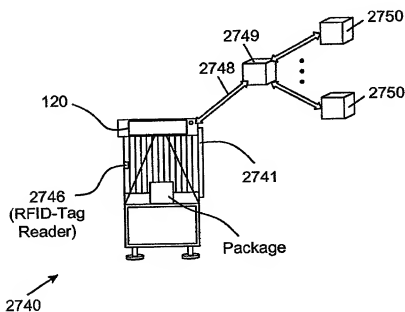


FIG. 72B

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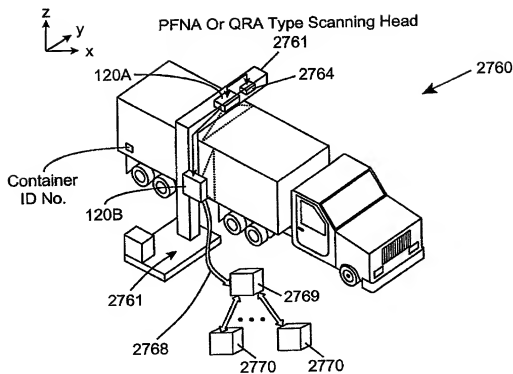


FIG. 73

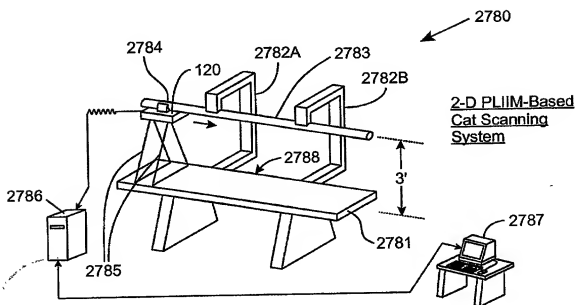
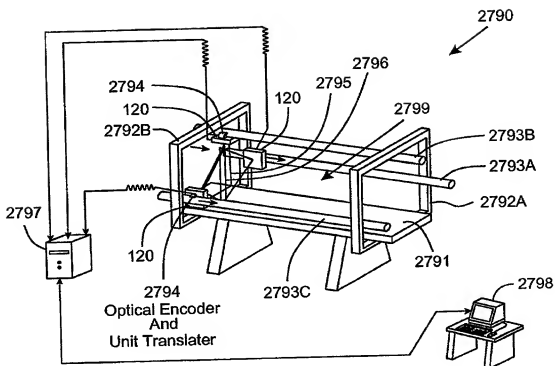


FIG. 74

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3-D PLIIM-Based
Cat Medical
Scanning System

FIG. 75

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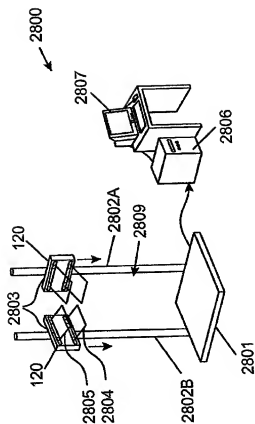


FIG. 76

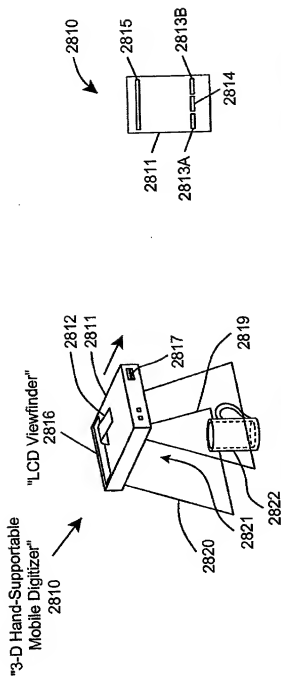


FIG. 77B

FIG. 77A

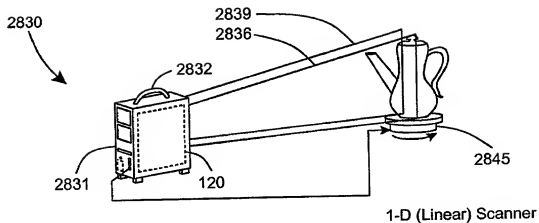


FIG. 78A

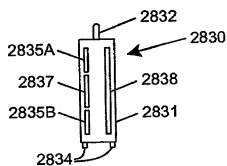


FIG. 78B

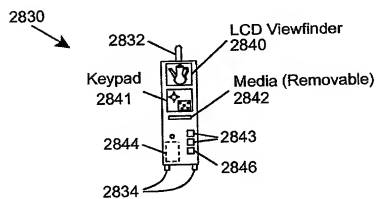


FIG. 78C

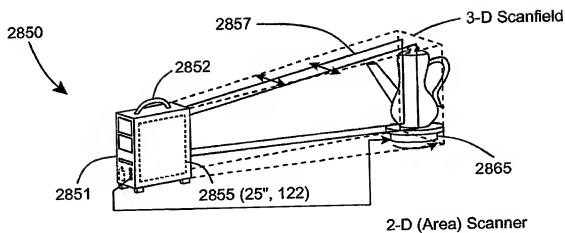


FIG. 79A

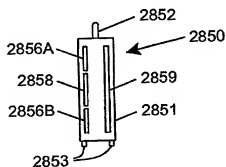


FIG. 79B

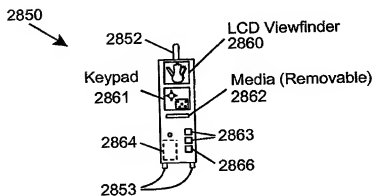


FIG. 79C

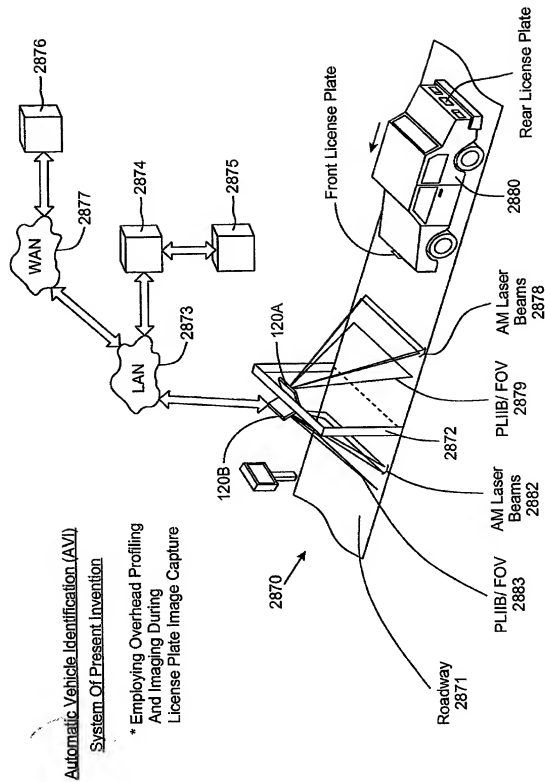


FIG. 80

**Automatic Vehicle Identification (AVI)
System Of Present Invention**

- * Employing Overhead Profiling
And Imaging Techniques During
License Plate Image Capture

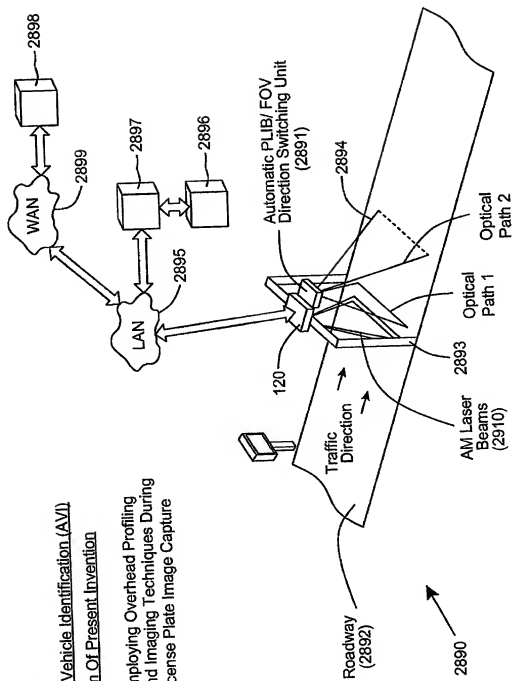
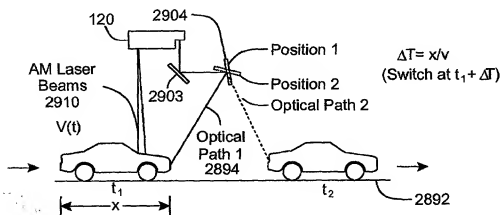
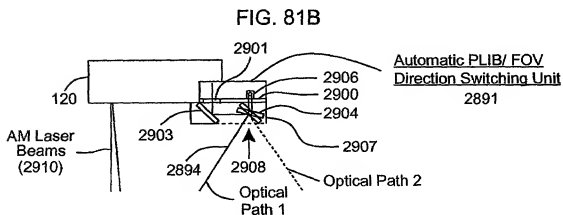
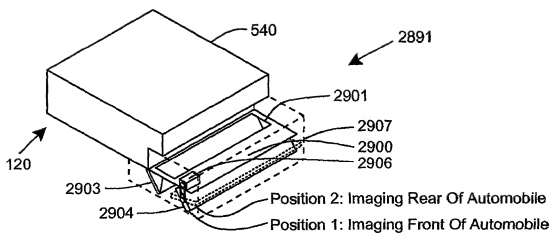
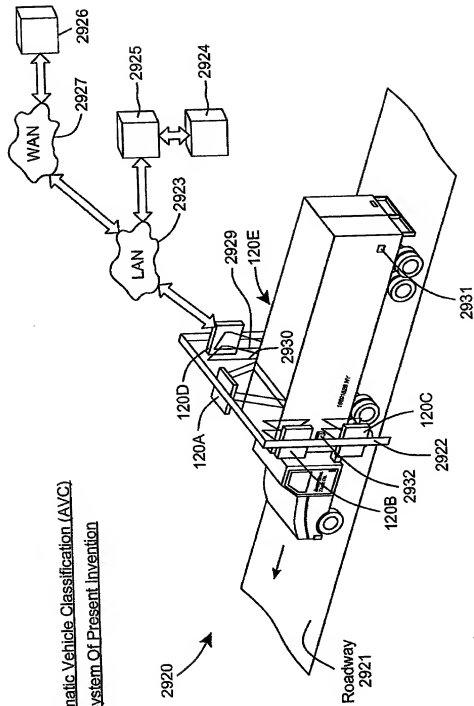


FIG. 81A



Automatic Vehicle Classification (AVC)
System Of Present Invention



* Employing Overhead And Lateral
Profiling And Imaging Techniques

FIG. 82

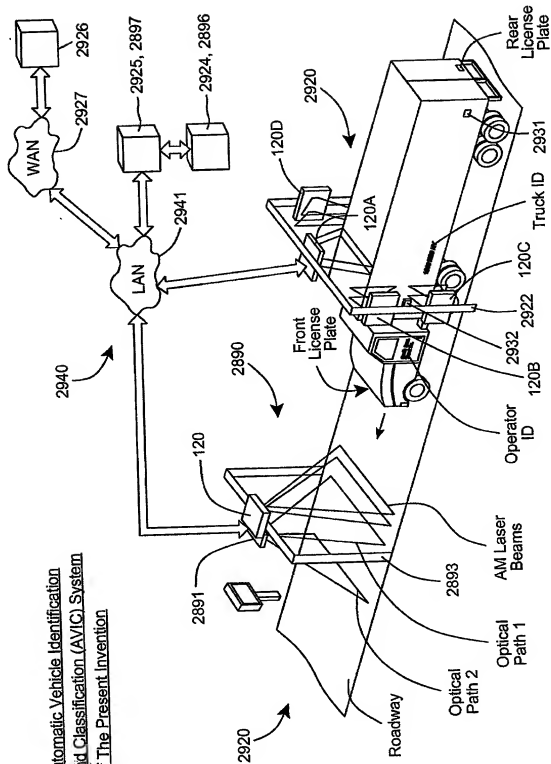


FIG. 83

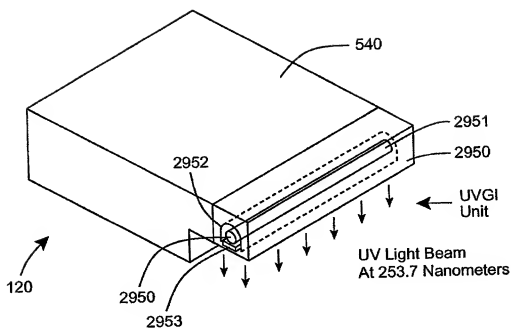


FIG. 84A

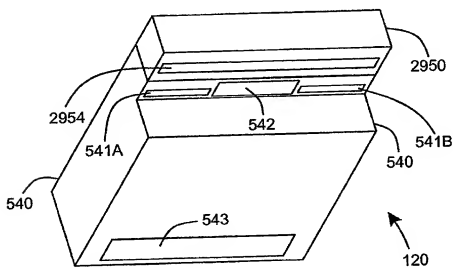


FIG. 84B

10091339-071202

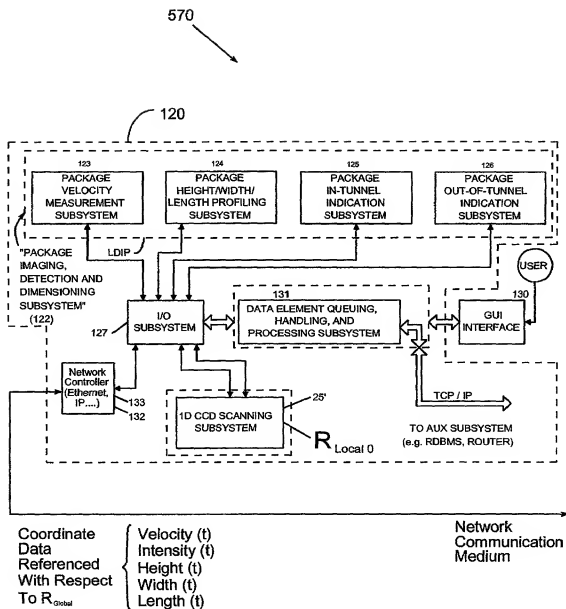


FIG. 30-1

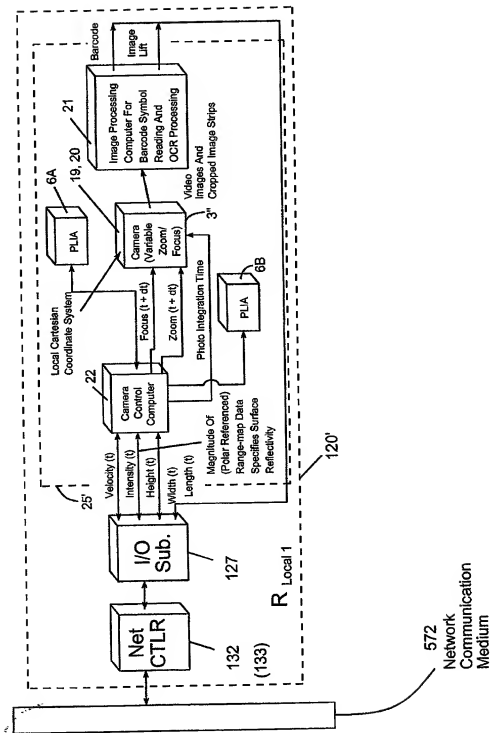


FIG. 30-2

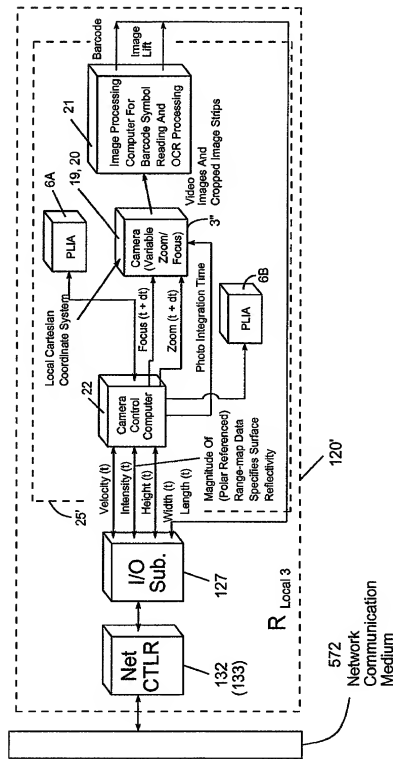
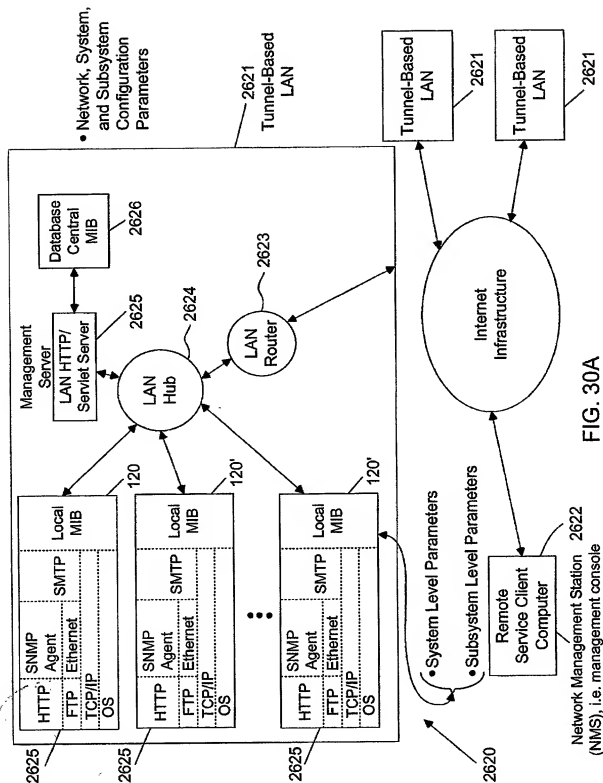


FIG. 30-4



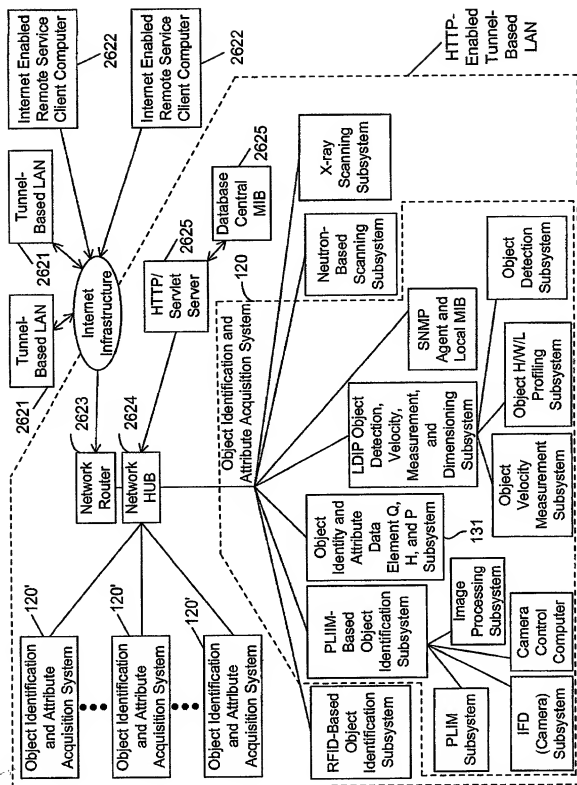


FIG. 30B

Network Configuration Parameters:

[Router IP address; no. of nodes (i.e. systems) in LAN; passwords, LAN location; name of customer facility; technical contact; phone no.; domain name; object identity codes; object attribute acquisition codes;.....]

System Configuration Parameters:

[System IP Address; passwords; object identity codes; object attribute acquisition codes;.....]

These subsystems generate object identity parameters

Monitorable and/or Configurable Parameters for Subsystems Within Each System:

- PLIM-based object identification subsystem: [object identity code; object attribute acquisition codes;.....]
- PLIM Subsystem: [VLD status; power VLD; TIM function; temp;.....]
- IFD (Camera) Subsystem: [sensor temp;]
- Image Processing Subsystem (Computer): [processor load history; system up time; # of frames (pgs); barcode read rate; current line rate;.....]
- Camera Contact Subsystem (Computer): [number of frames dropped; number of focused zoom commands; number and kinds of motor control errors;.....]
- RFID-based object identification subsystem: [.....]
- Object identity and attribute data element queuing, handling and processing subsystem: [.....]
- LDIP object identification, velocity-measurement, and dimensioning subsystem: [.....]
- Object velocity measurement subsystem: [polygon RPM; polygon laser output X; channel X drift; channel X noise; trigger error events; instant lock reference drift; temperature]
- Object HW/L profiling subsystem
- Object detection subsystem: [non- singulation/ singulation code;.....]

This system links object attribute data element parameters(i.e. object identity data element) to corresponding object identity parameters (i.e. object attribute data element)

These subsystems generate object attribute parameters

• X-ray scanning subsystem: [.....]

• Neutron-beam scanning subsystem: [.....]

FIG. 30C

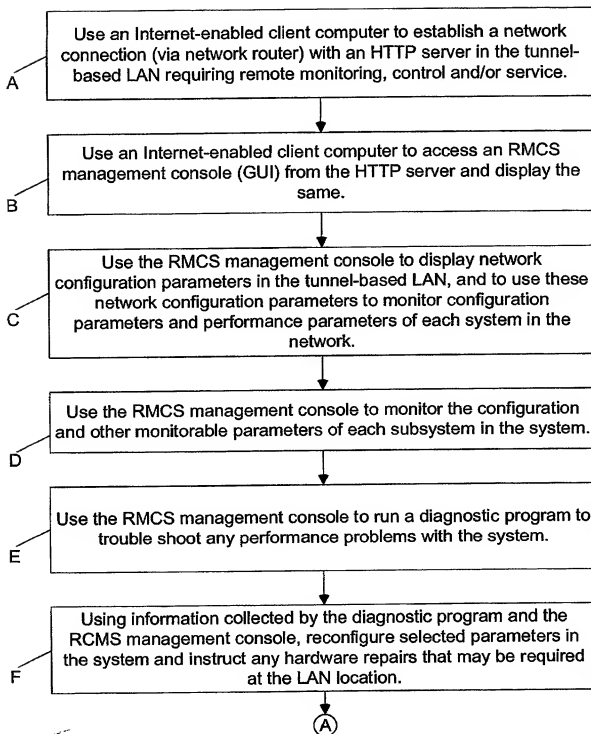


FIG. 30D1

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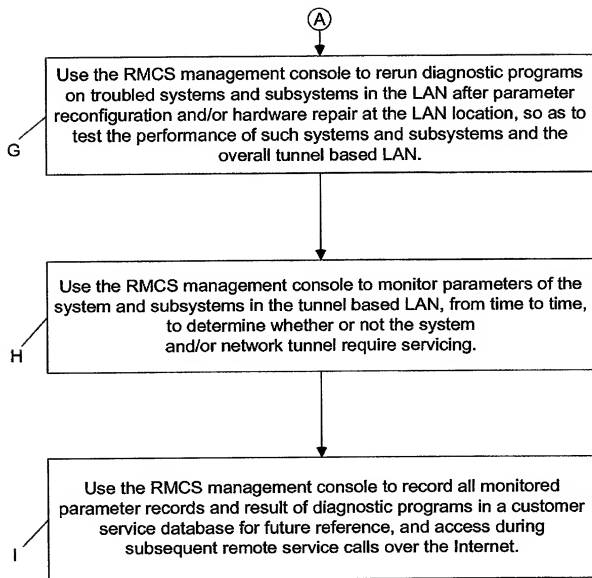
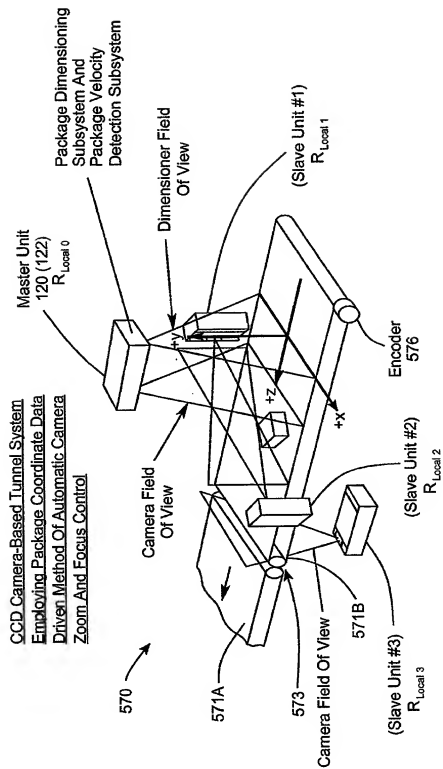


FIG. 30D2



Package Coordinate Data $|R_{Global}$ \xrightarrow{HG} Package Coordinate Data II $R_{Local\ i}$

FIG. 31

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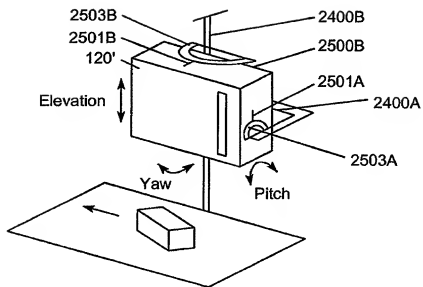


FIG. 31A

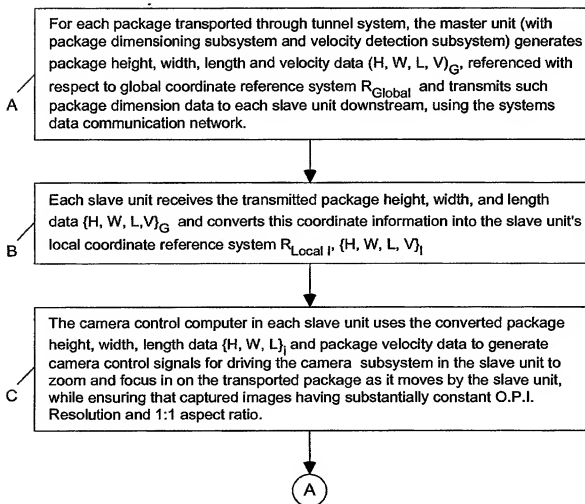


FIG. 32A

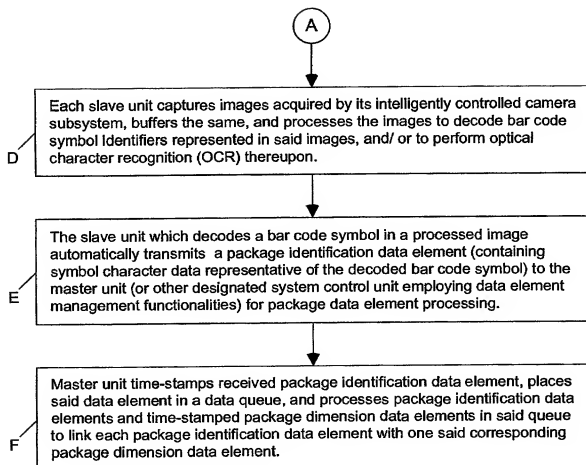
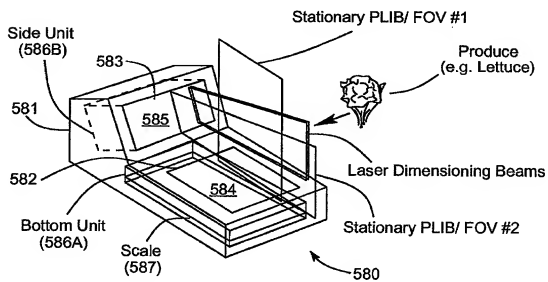
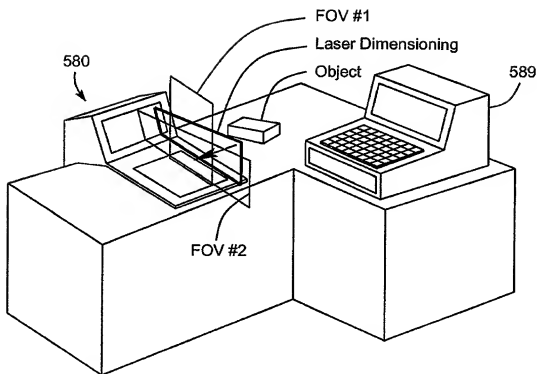


FIG. 32B



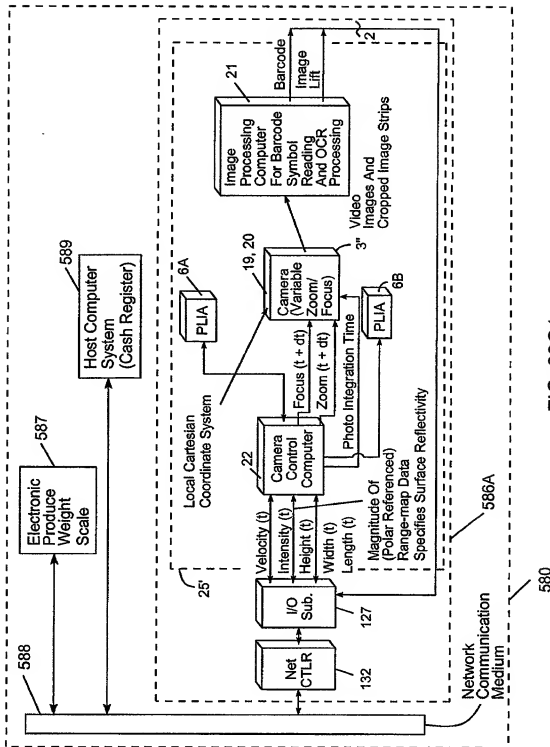


FIG. 33C1

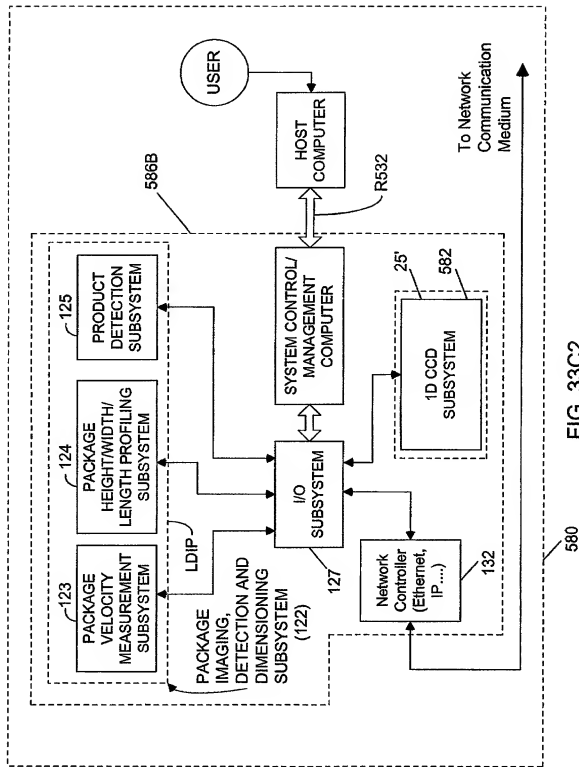


FIG. 33C2

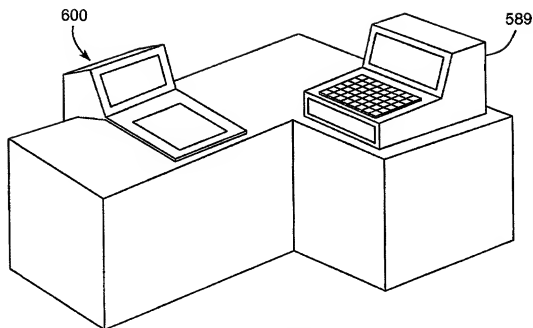


FIG. 34A

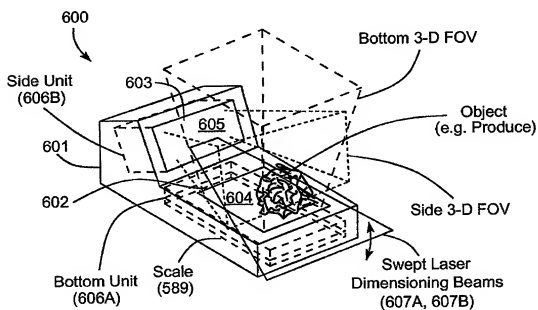


FIG. 34B

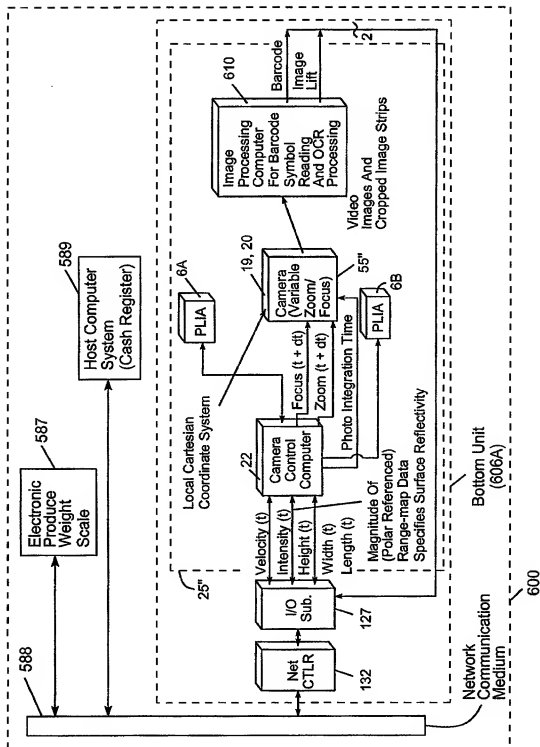


FIG. 34C1

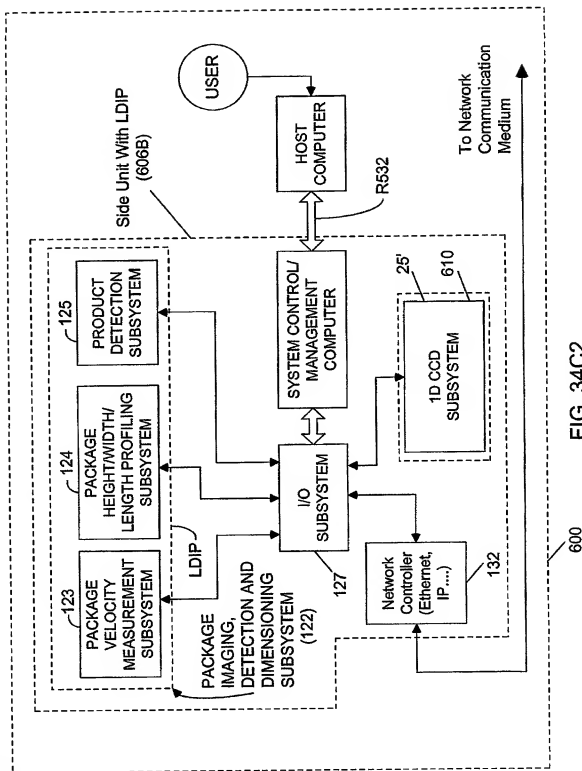


FIG. 34C2

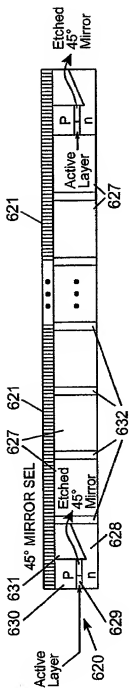


FIG. 36A

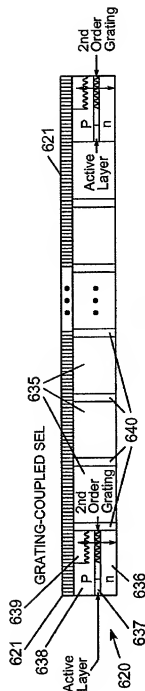


FIG. 36B

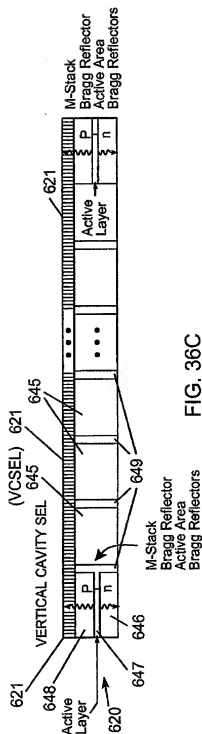


FIG. 36C

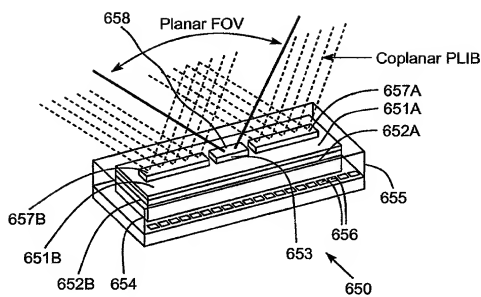


FIG. 37

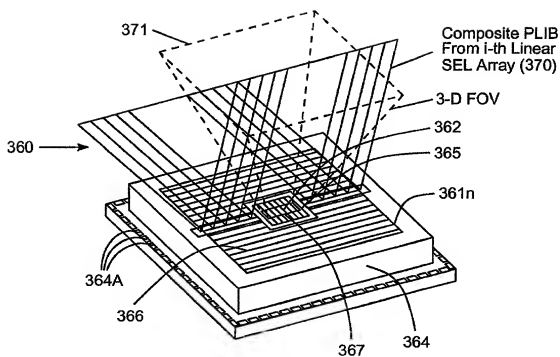


FIG. 38A

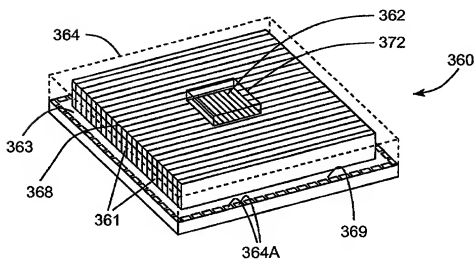


FIG. 38B

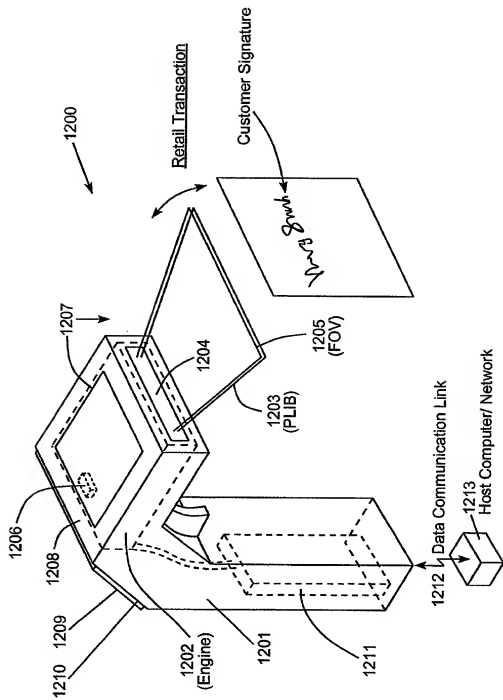


FIG. 39A

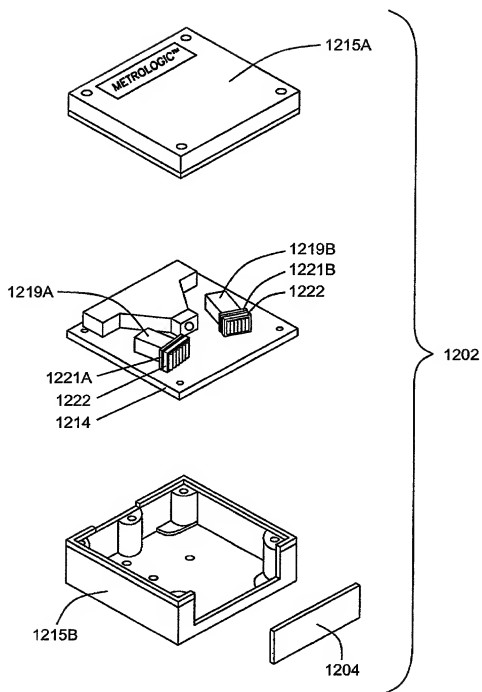


FIG. 39B

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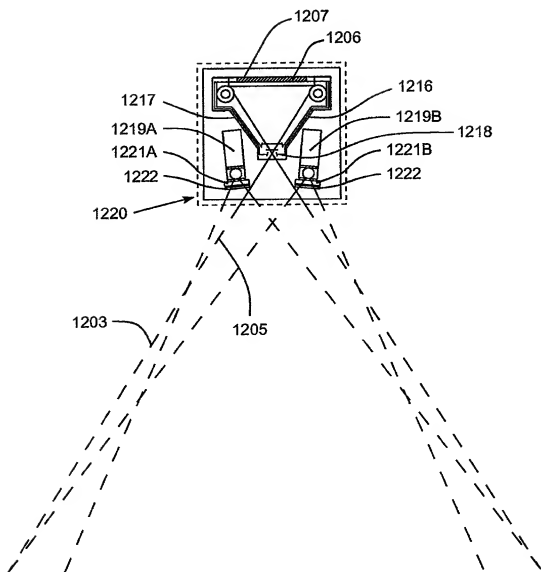


FIG. 39C

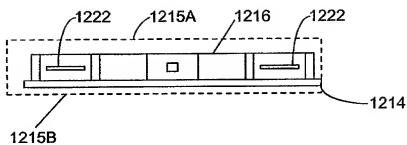


FIG. 39D

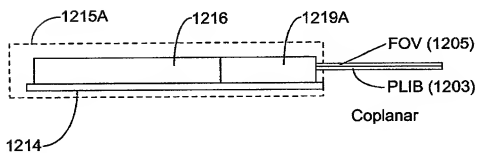


FIG. 39E

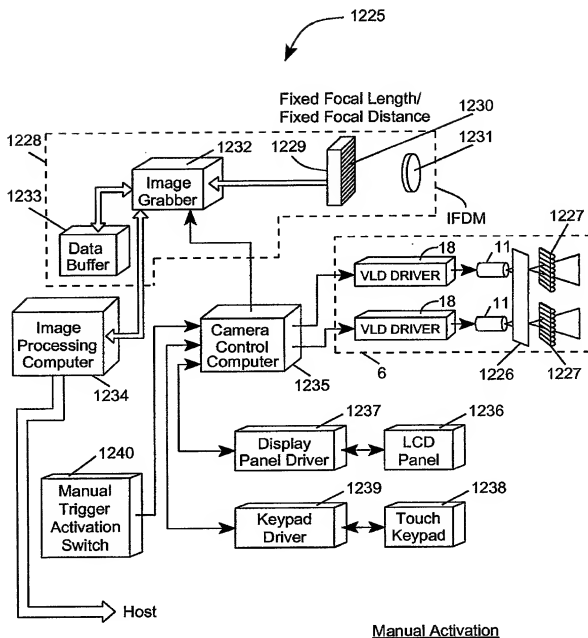
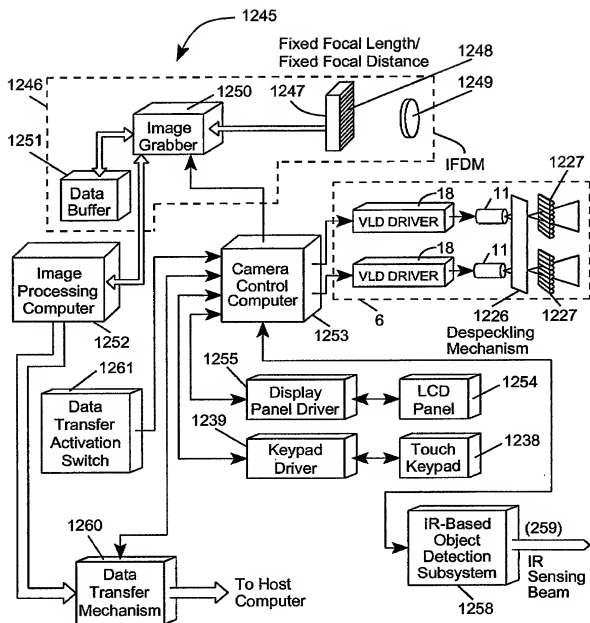


FIG. 40A1



Automatic with IR Object Detection

FIG. 40A2

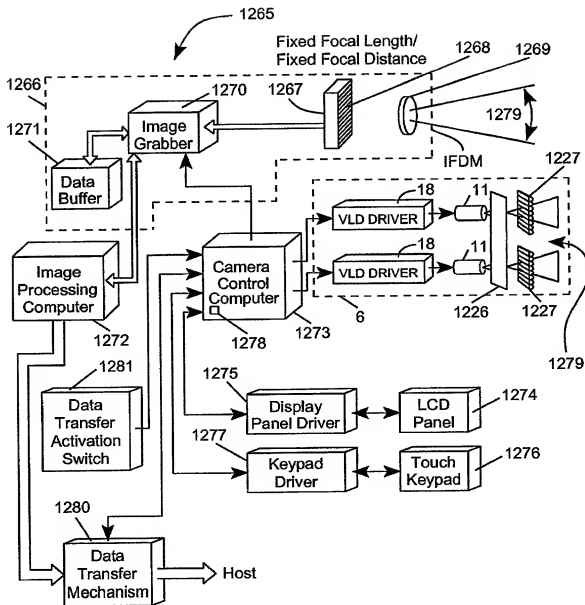
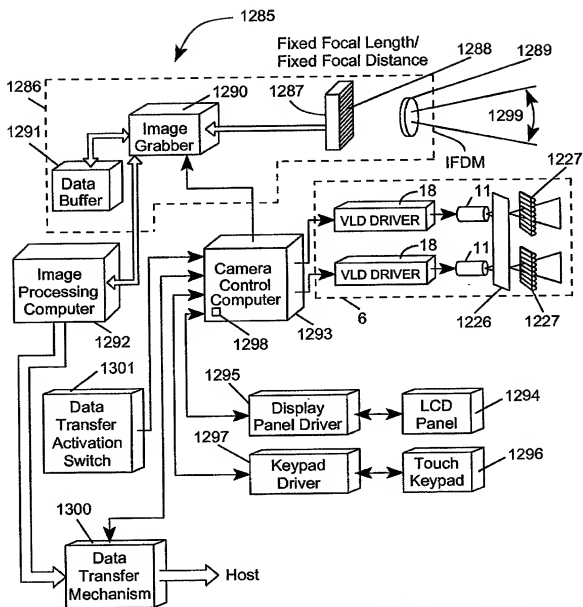


FIG. 40A3



Automatic with Passive CCD
Based Object Detection

FIG. 40A4

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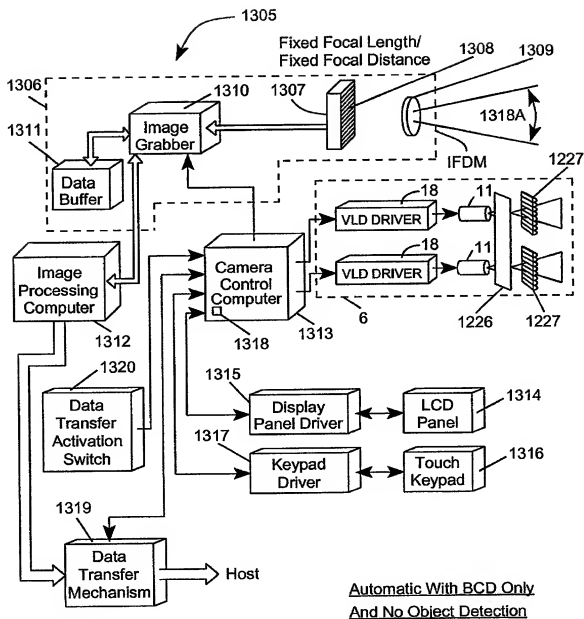


FIG. 40A5

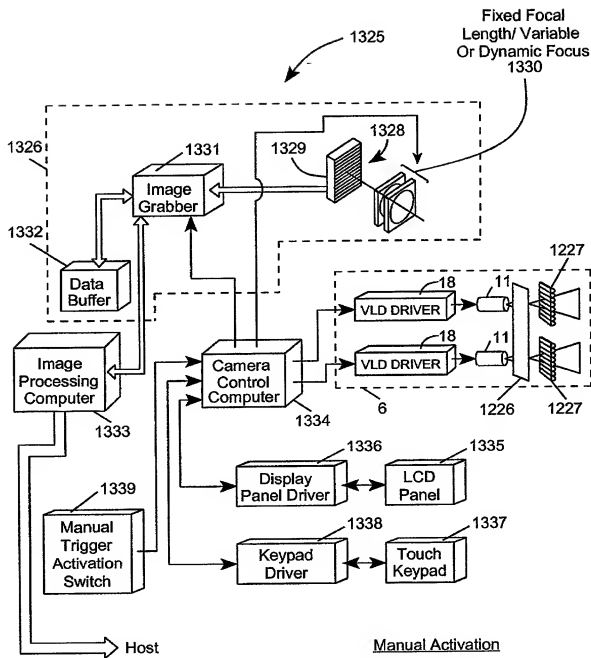
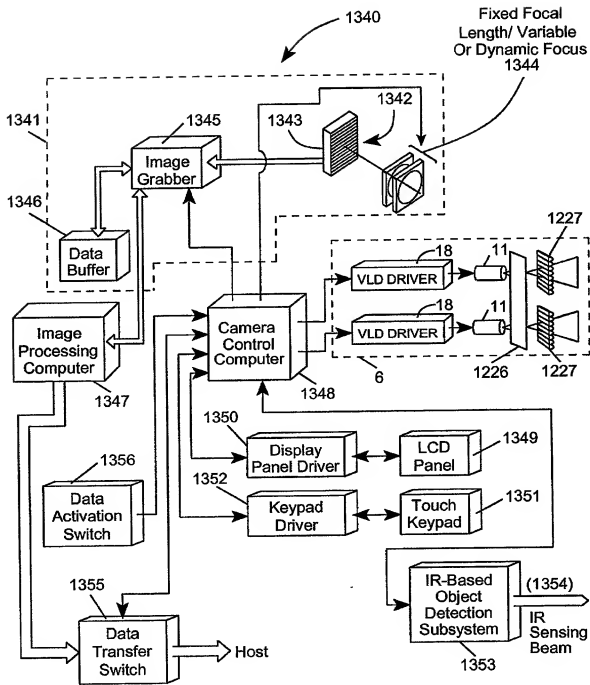


FIG. 40B1



Automatic With IR-Based
Object Detection

FIG. 40B2

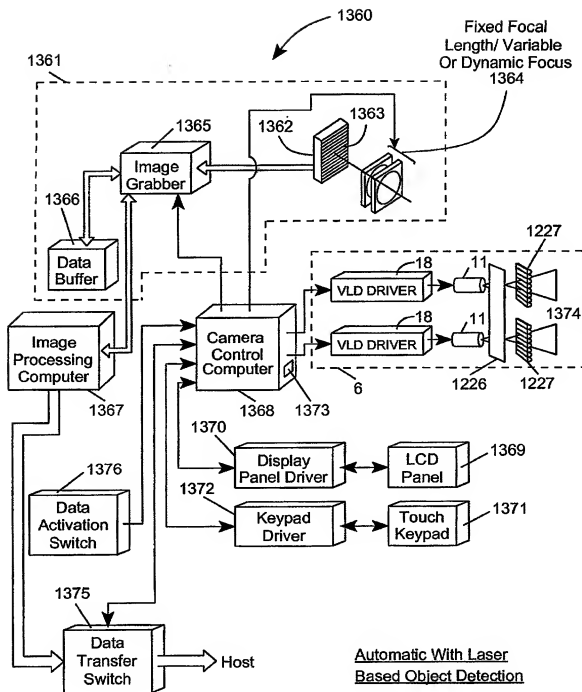


FIG. 40B3

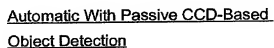


FIG. 40B4

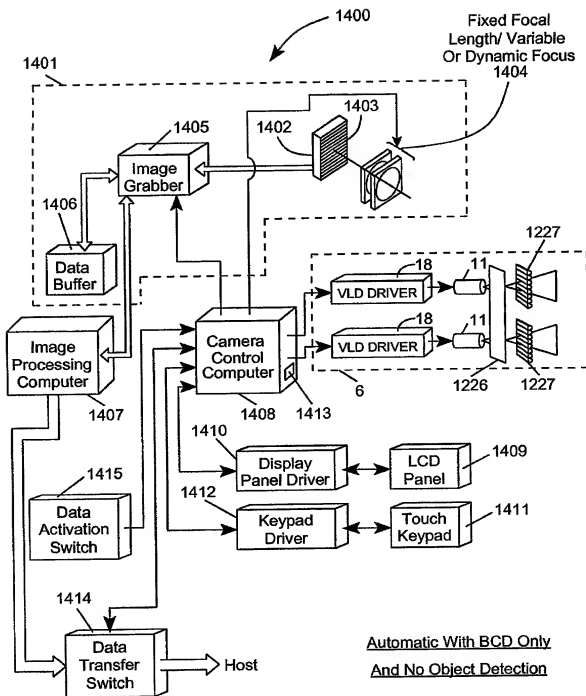
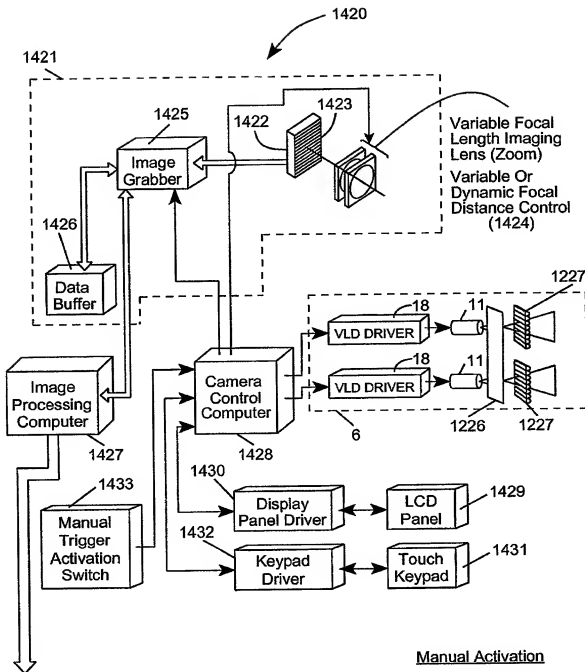


FIG. 40B5



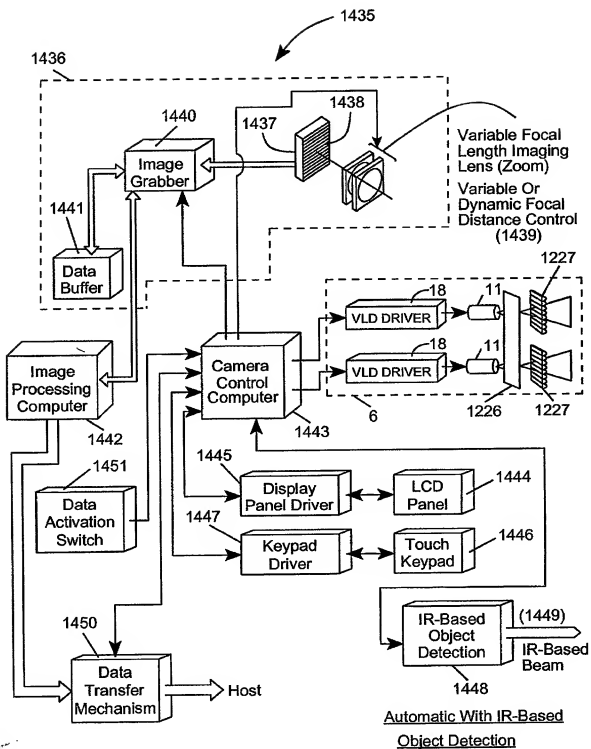


FIG. 40C2

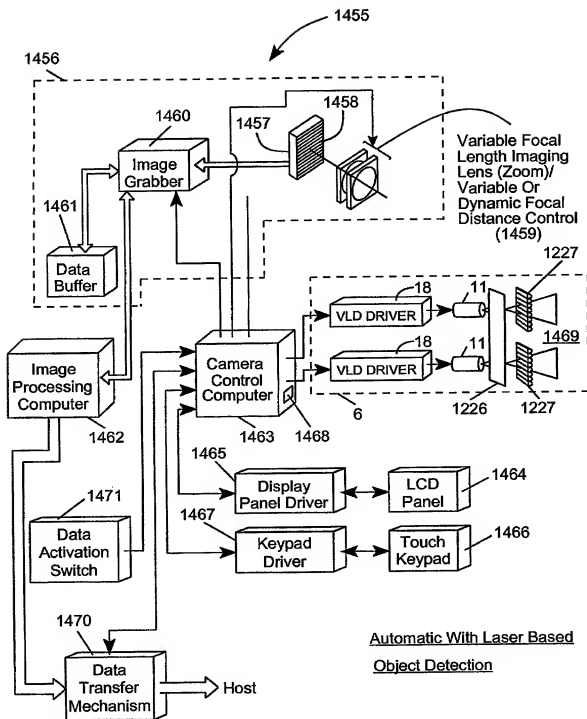


FIG. 40C3

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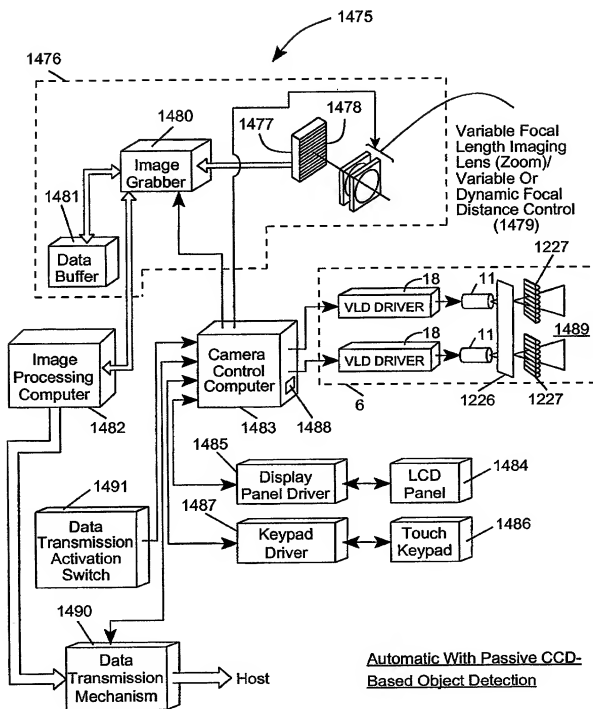


FIG. 40C4

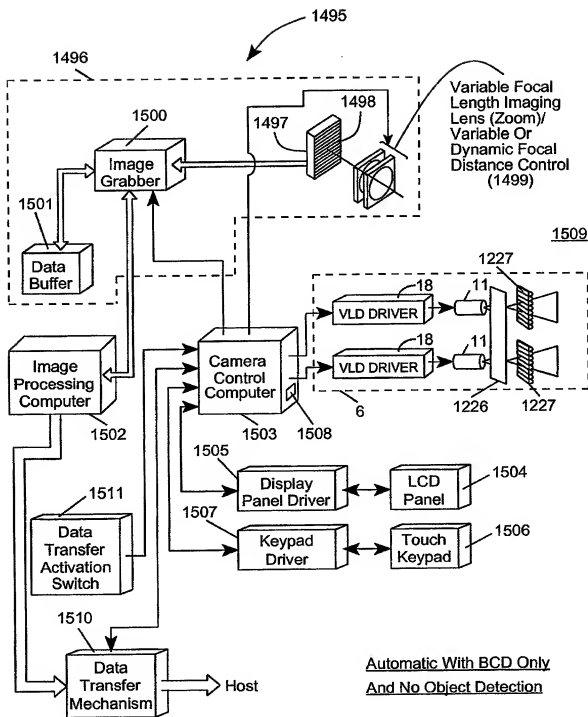


FIG. 40C5

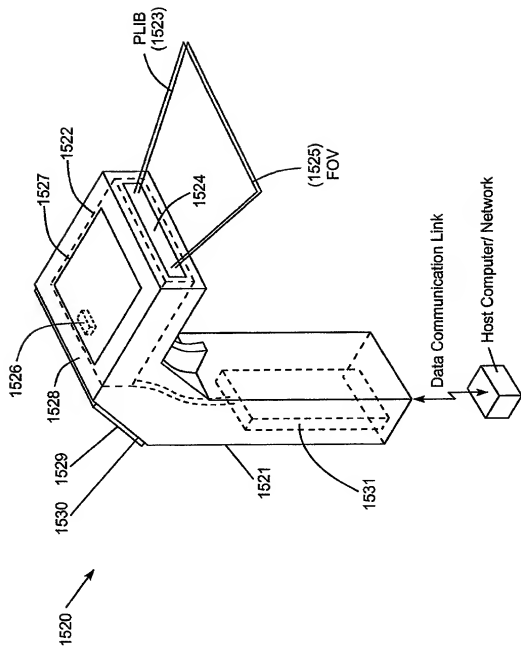
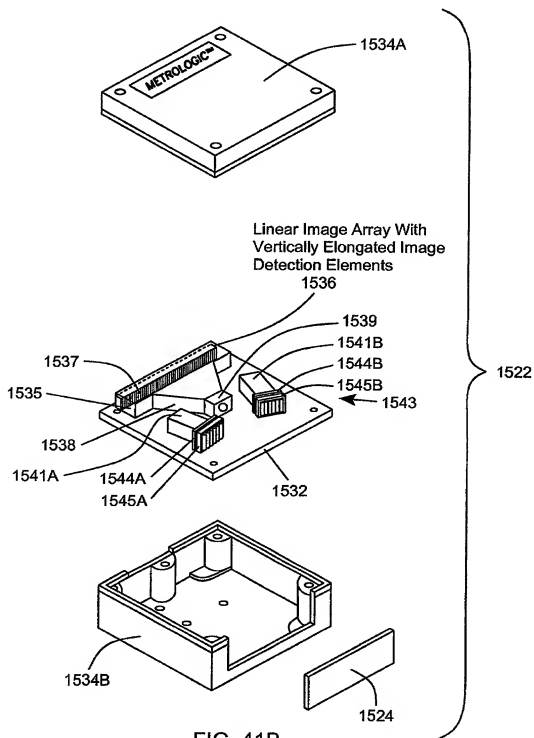


FIG. 41A



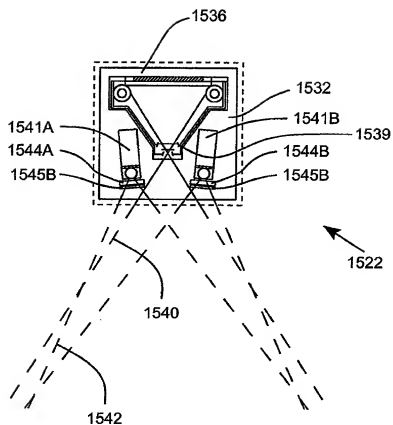


FIG. 41C

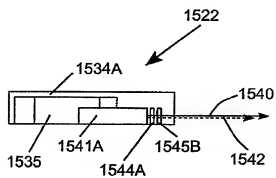


FIG. 41D

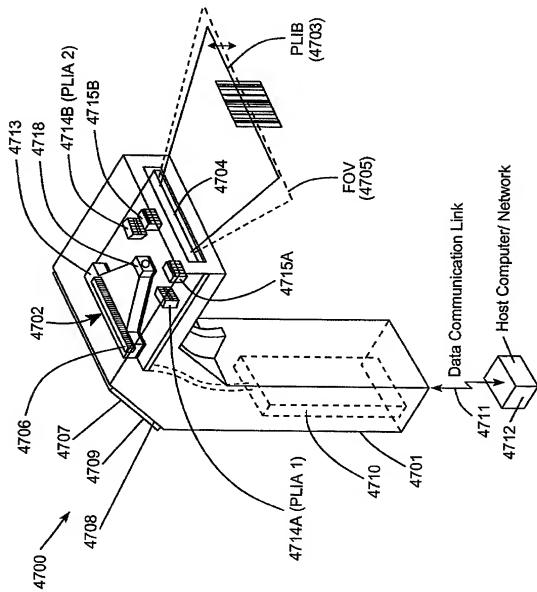


FIG. 42

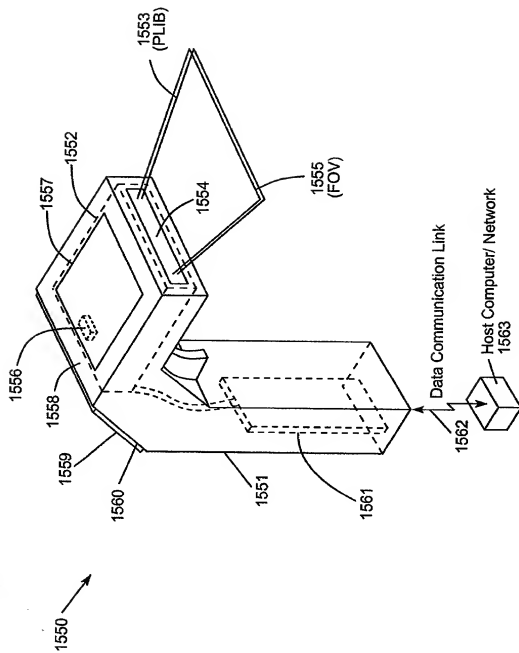


FIG. 42A

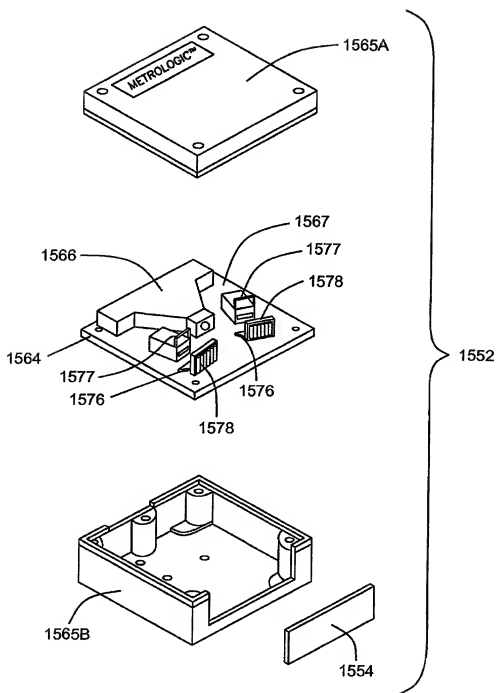


FIG. 42B

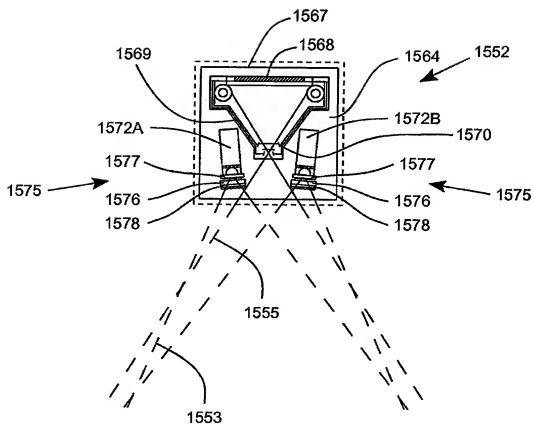


FIG. 42C

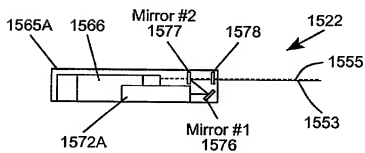


FIG. 42D

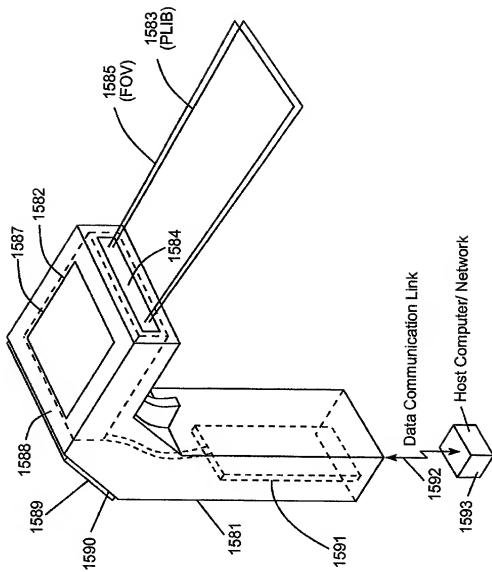


FIG. 43A

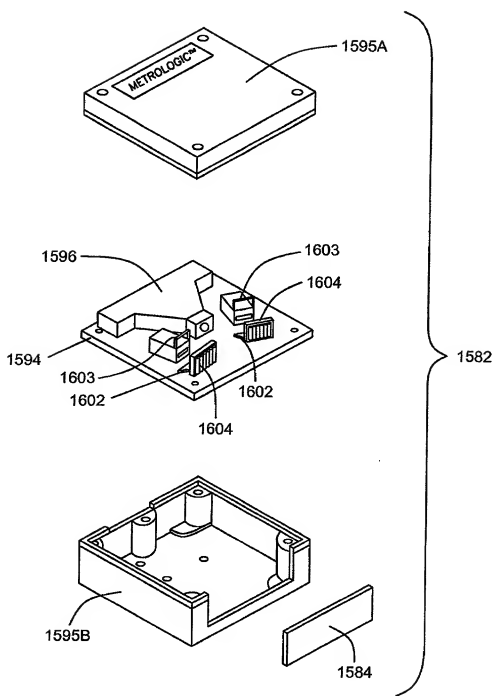


FIG. 43B

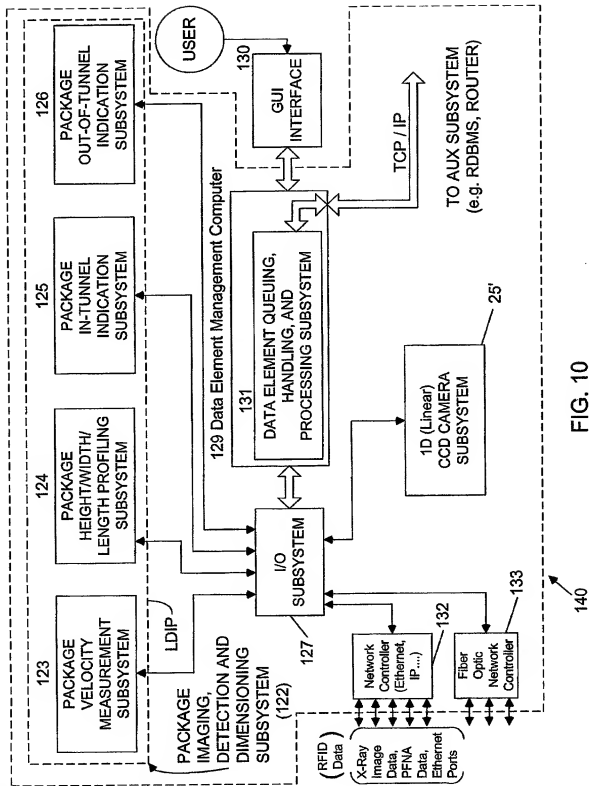


FIG. 10

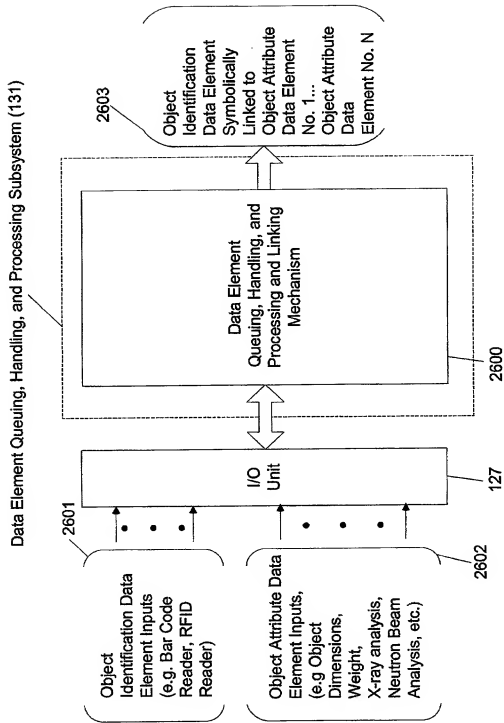


FIG. 10A

Primary Network and/or System Functions:

- A. Specification of Object Detection and Tracking Capability of System
- B. Specification of Object Identification Capability of System
- C. Specification of Object Attribute Acquisition Capability of System

Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.

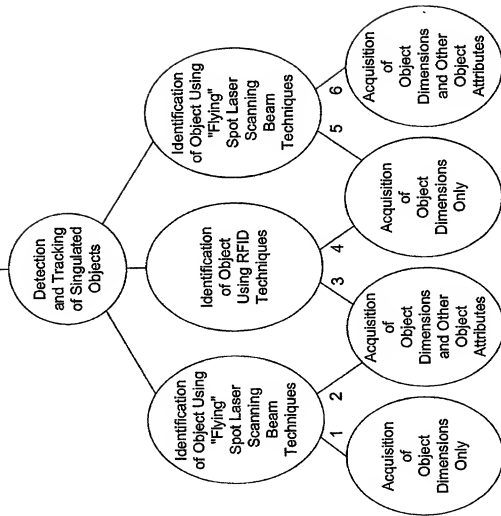


FIG. 10B-1

Primary Network and/or System Functions:

A. Specification of Object Detection and Tracking Capability of System

B. Specification of Object Identification Capability of System

C. Specification of Object Attribute Acquisition Capability of System

Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.

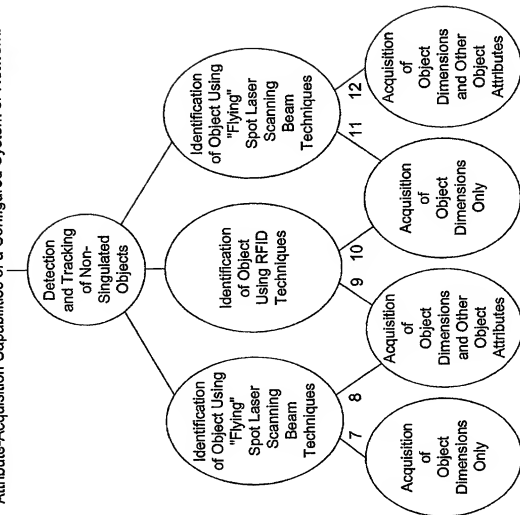


FIG. 10B-2

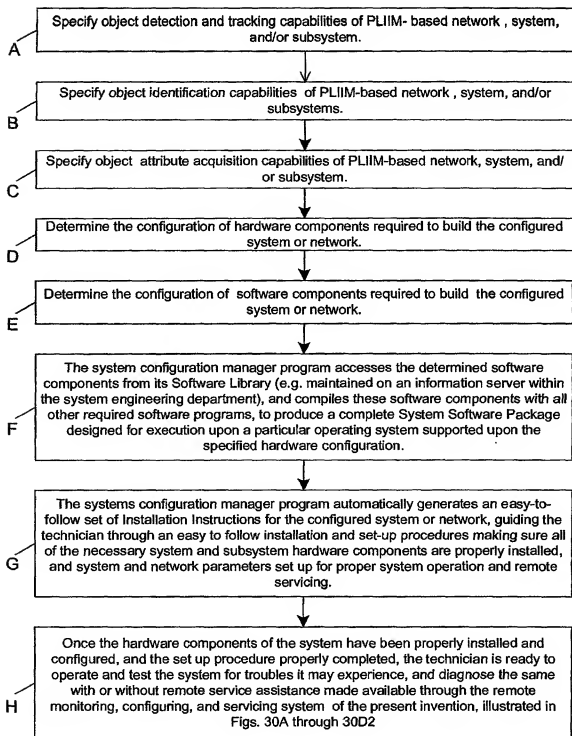


FIG. 10C

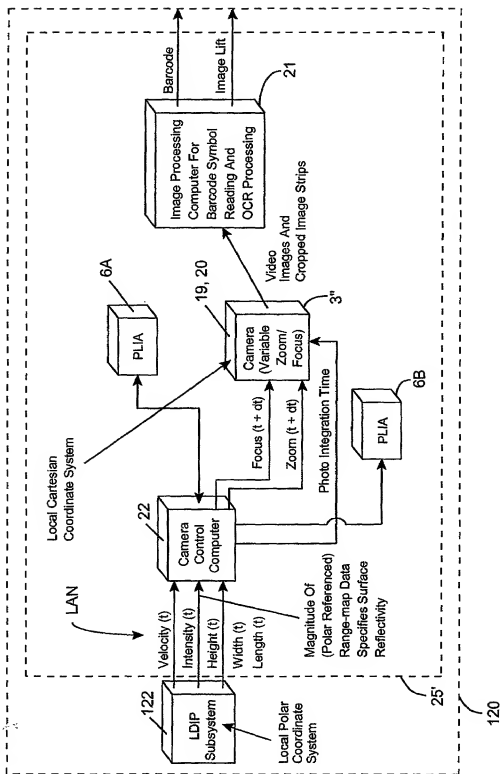


FIG. 11

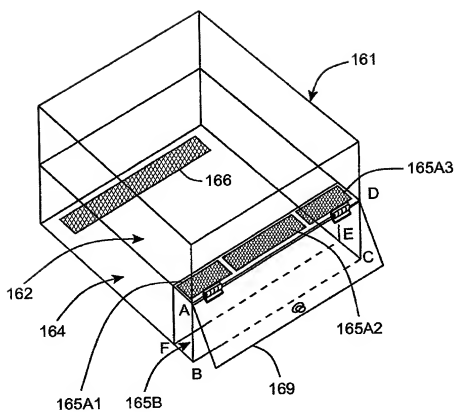


FIG. 12A

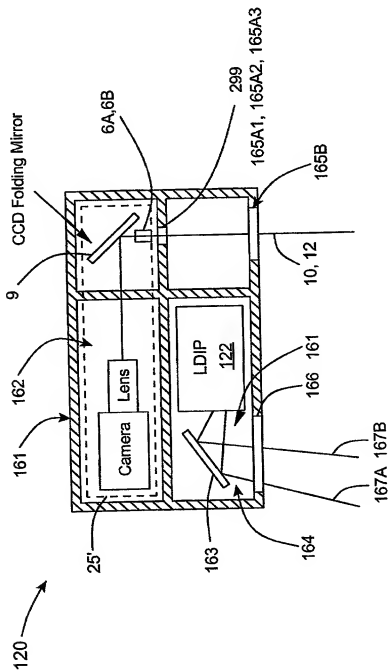
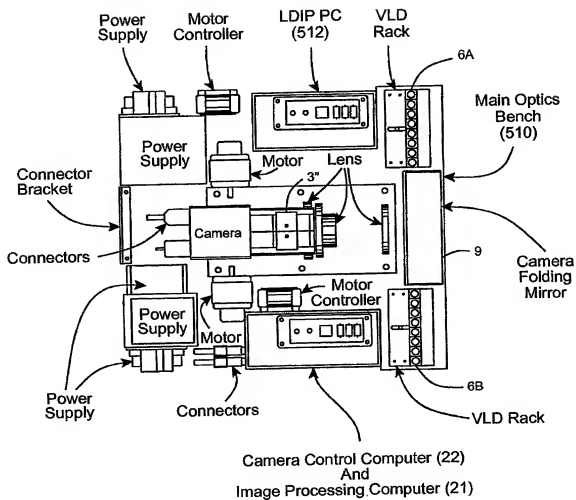


FIG. 12B



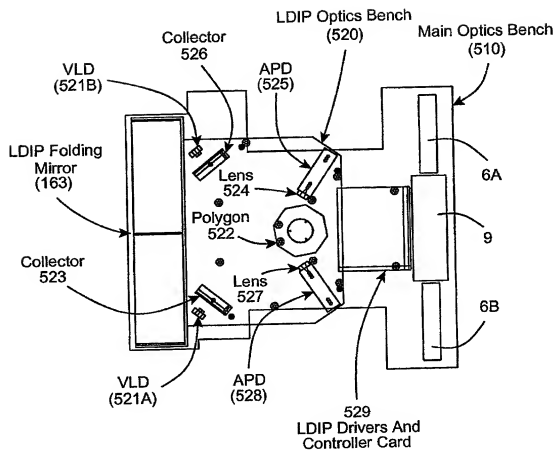
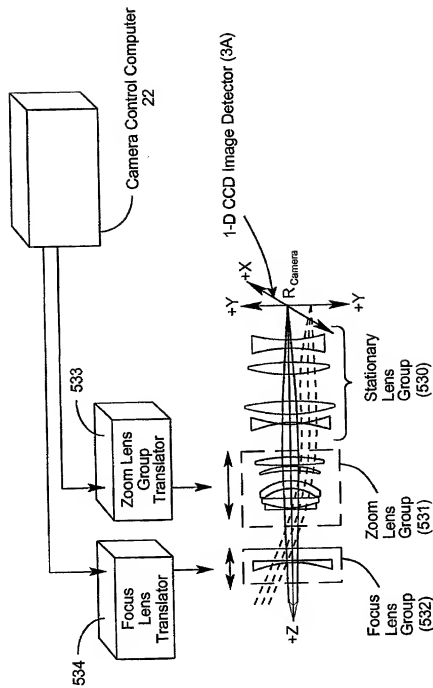


FIG. 12D



Main Optics Lens Groups

FIG. 12E

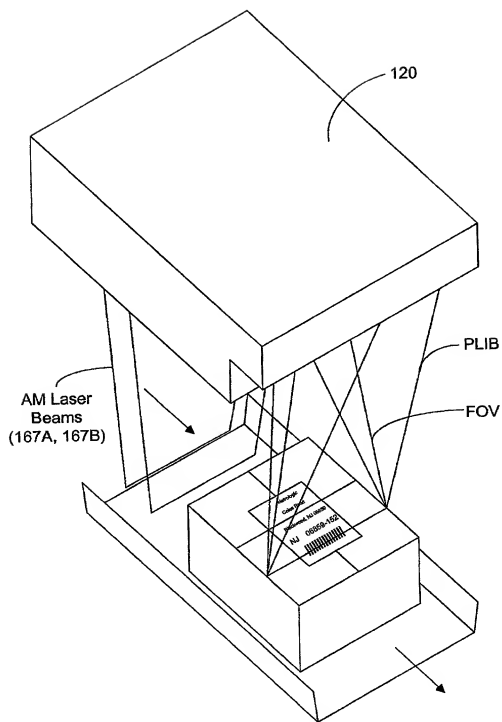


FIG. 13A

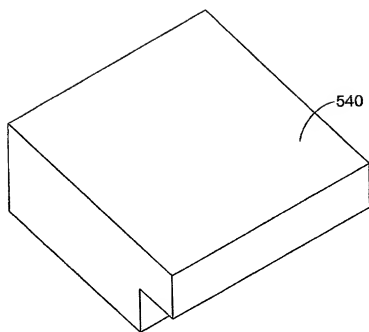


FIG. 13B

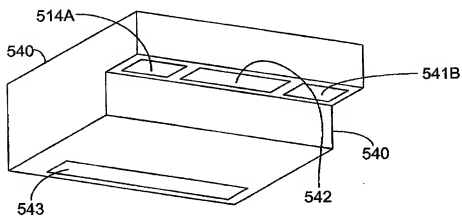


FIG. 13C

PLIIM-BASED PACKAGE IDENTIFICATION AND DIMENSIONING (PID) SYSTEM

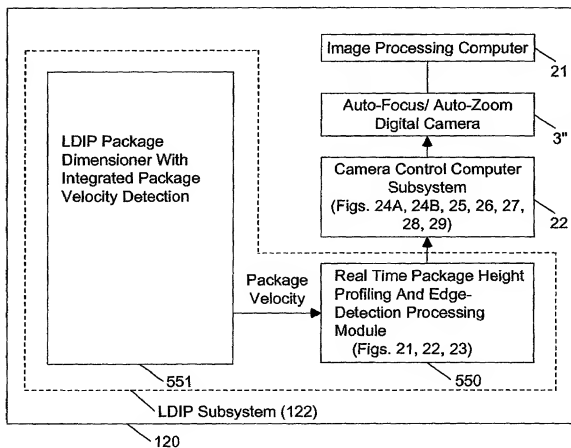


FIG. 14

LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

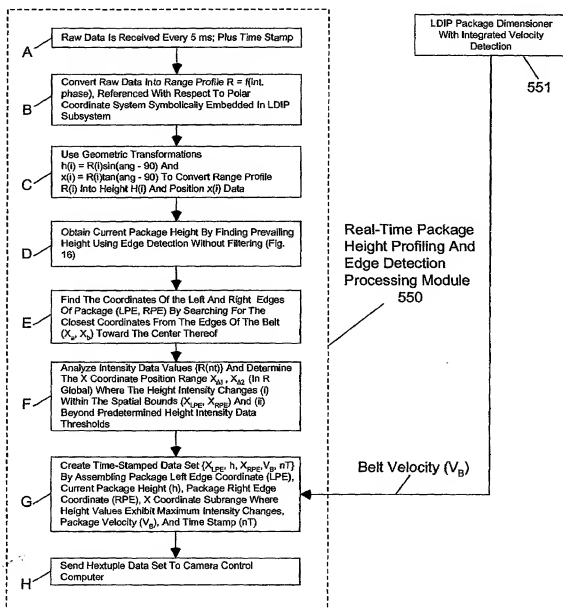


FIG. 15

LDIP REAL-TIME PACKAGE EDGE DETECTION

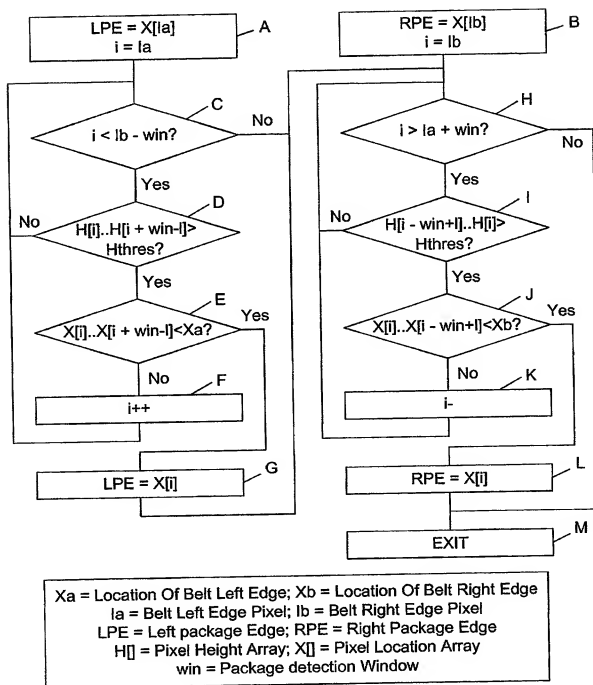


FIG. 16

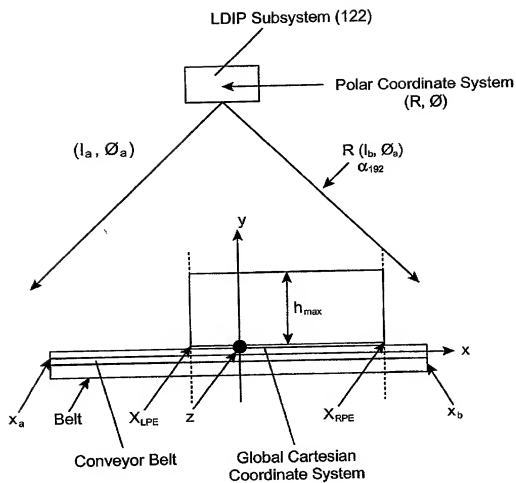


FIG. 17

Information Measured At Scan Angles Before
Coordinate Transformations

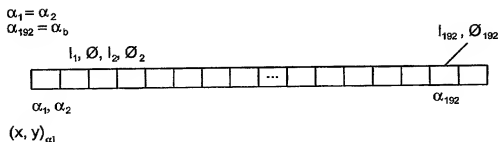


FIG. 17A

Range And Polar Angle Measures Taken At Scan
Angle α Before Coordinate Transforms

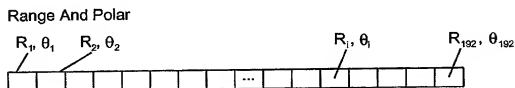


FIG. 17B

Measured Package Height And Position Values
After Coordinate Transformations

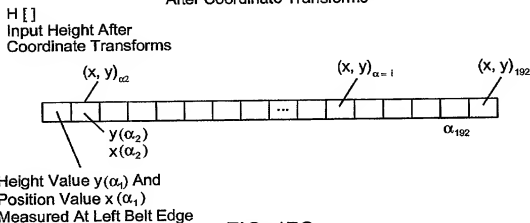


FIG. 17C

CAMERA CONTROL PROCESS CARRIED OUT WITHIN THE CAMERA
CONTROL SUBSYSTEM OF EACH OBJECT IDENTIFICATION AND
ATTRIBUTE ACQUISITION SYSTEM OF PRESENT INVENTION

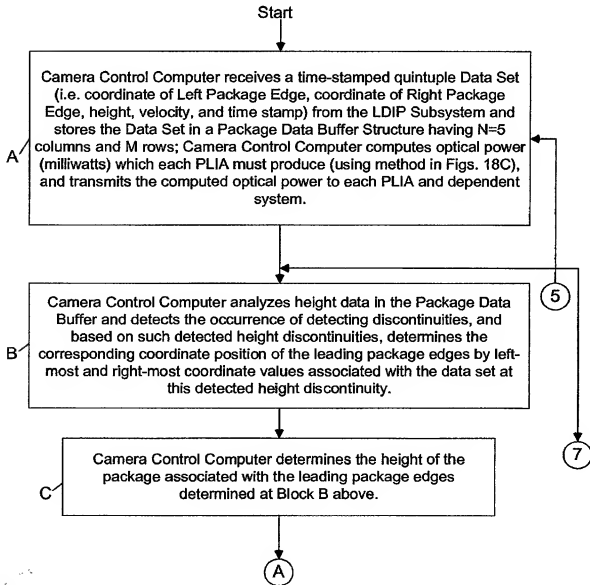


FIG. 18A-1

10091339-071202

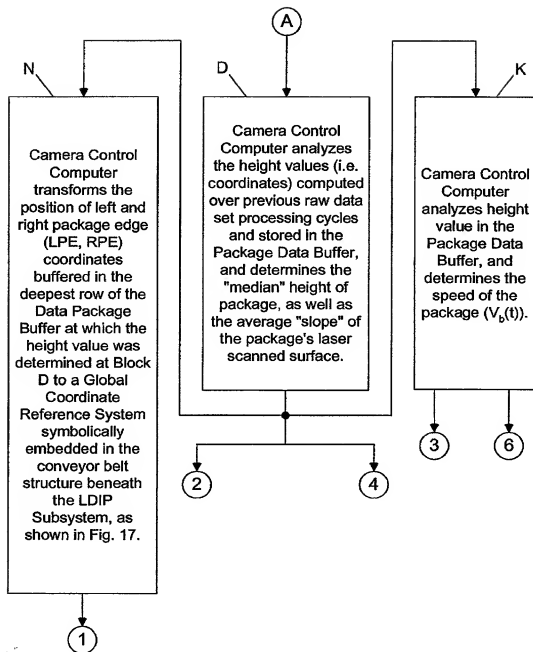


FIG. 18A-2

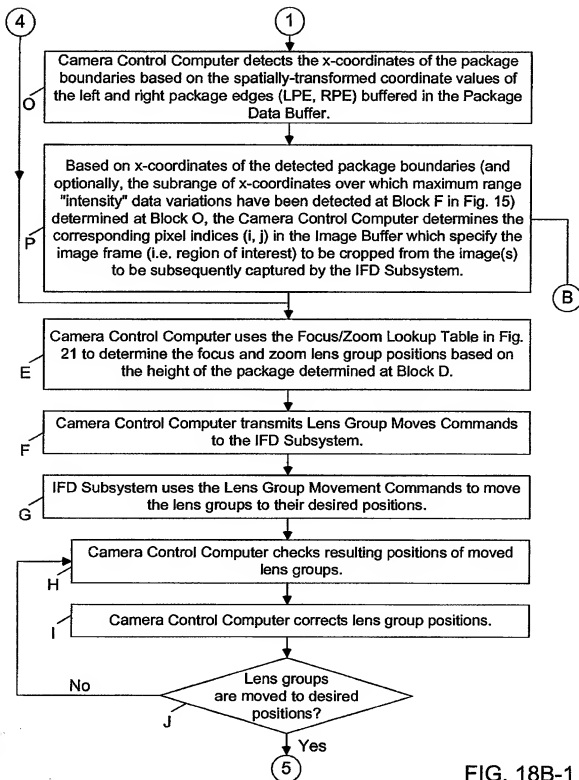


FIG. 18B-1

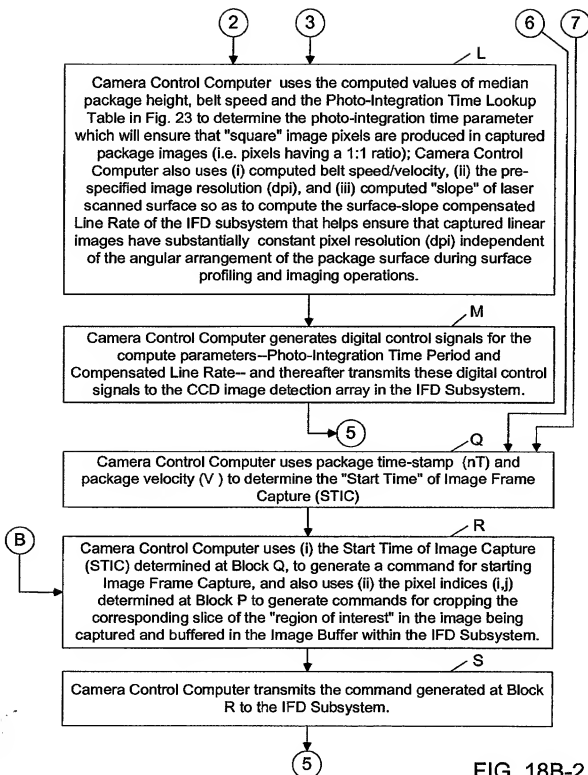


FIG. 18B-2

METHOD OF COMPUTING OPTICAL OUTPUT POWER FROM LASER
DIODES IN A PLANAR LASER ILLUMINATION ARRAY (PLIA) FOR
CONTROLLING THE CONSTANT WHITE-LEVEL IN IMAGE PIXELS
CAPTURED BY A PLIIM-BASED LINEAR IMAGER

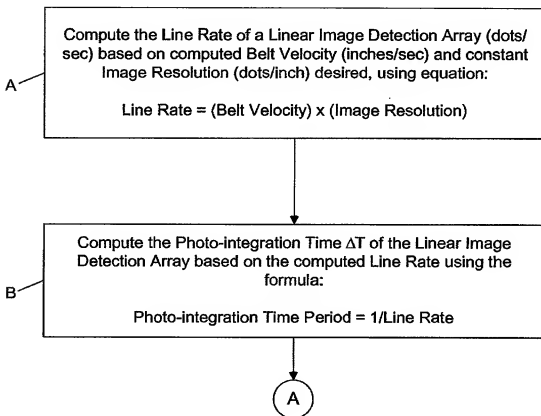


FIG. 18C1

11/512

A



Compute the Optical Power (milliwatts) of each PLIA based on the computed Photo-integration Time Period (ΔT) using the following formula:

$$\text{Optical Power of VLD (milliwatts)} = \frac{\text{constant}}{\text{Photo-integration Time Period } \Delta T}$$

FIG. 18C2

10091339.071202

METHOD OF COMPUTING COMPENSATED LINE RATE FOR CORRECTING
VIEWING-ANGLE DISTORTION OCCURING IN IMAGES OF OBJECT
SURFACES CAPTURED AS OBJECT SURFACES MOVE PAST A PLIIM-
BASED LINEAR IMAGER AT NON-ZERO SKEWED ANGLE

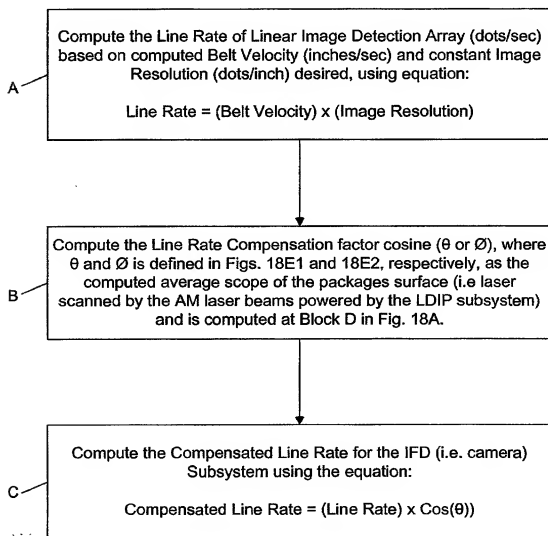


FIG. 18D

CASE 1:
Top Down Imaging

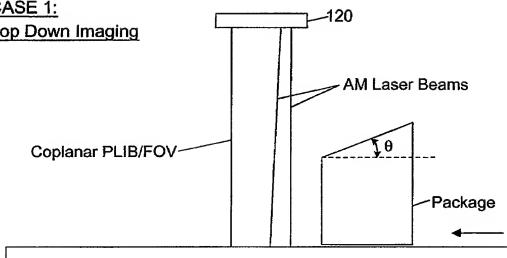


FIG. 18E1

CASE 2:
Side Imaging

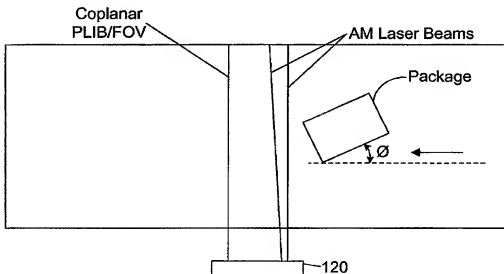


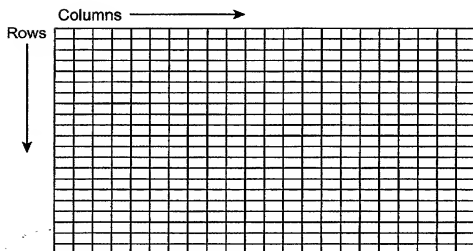
FIG. 18E2

X Coordinate Subrange Where
Maximum Range "Intensity"
Variations Have Been Detected

Left Package Edge (LPE)	Package Height (h)	Right Package Edge (RPE)	Package Velocity	Time- Stamp (nT)	
					Row 1
					Row 2
					Row 3
					Row 4
					Row 5
					Row M

Package Data Buffer (FIFO)

FIG. 19



Camera Pixel Data Buffer

Pixel Indices (i, j)

FIG. 20

Zoom And Focus Lens Group Position
Look-Up Table

Distance From Camera H (mm)	Zoom Group Distance (mm) Y (Zoom)	Focus Group Distance (mm) Y (Focus)
1000	21.57489228	2.47E-05
1100	19.38089696	10.99009783
1200	17.10673434	20.65783177
1300	14.77137314	29.10917002
1400	12.39153565	36.47312595
(Use Interpolation	9.979114358	42.87845436
Techniques For	7.540639114	48.44003358
Working Distances	5.078794775	53.25495831
Between Listed	2.595989366	57.40834303
Points In Table)	0.099972739	60.98883615

FIG. 21

* Note: The focal distance and zoom (eff. focal length) of camera lens are coupled (inter-dependant) in this commercial embodiment.

Camera Has A Fixed Aperture F56 Focus And Zoom Lens Movement vs. Working Distances

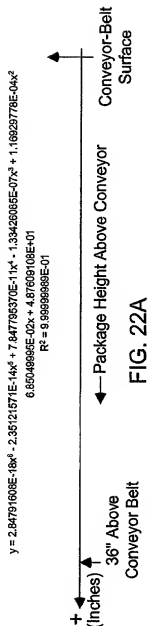
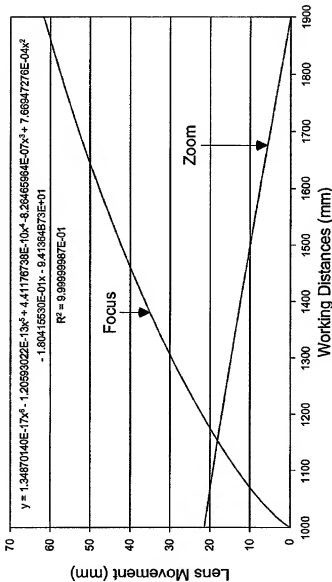


FIG. 22A

Photo-Integration Time Look-Up Table

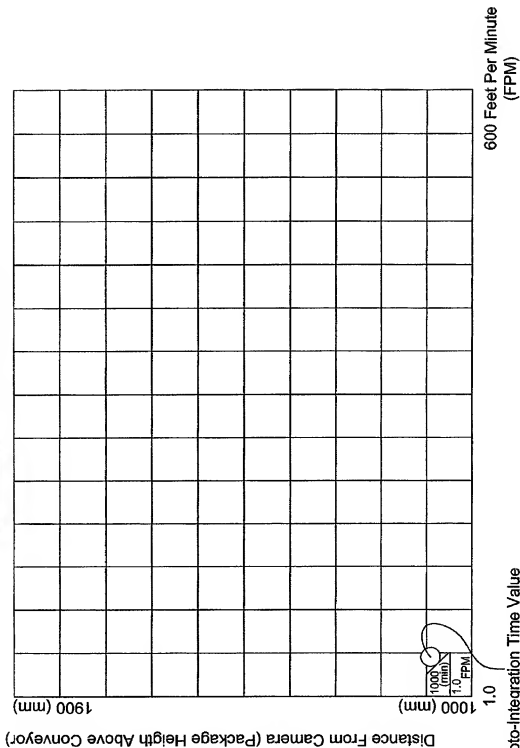


Photo-Integration Time Value
That Ensures Square Image
Pixels (1:1 aspect ratio)

FIG. 22B

METHOD OF AND APPARATUS FOR PERFORMING AUTOMATIC
RECOGNITION OF GRAPHICAL INTELLIGENCE CONTAINED IN 2-D
IMAGES CAPTURED FROM ARBITRARY 3-D OBJECT SURFACES

STEP 1: At the unitary PLIIM-based object imaging and profiling system, use the laser doppler imaging and profiling (LDIP) subsystem employed therein to (i) consecutively capture a series of linear 3-D surface profile maps on a targeted arbitrary (e.g. non-planar or planar) 3-D object surface bearing forms of graphical intelligence and (ii) measure the velocity of the arbitrary 3-D object surface, wherein the polar coordinates of each point in the captured linear 3-D surface profile map are specified in a local polar coordinate system $R_{LDIP/polar}$ symbolically embedded within the LDIP subsystem.

A

STEP 2: At the unitary PLIIM-based object imaging and profiling system, use coordinate transforms to automatically convert the polar coordinates of each point $p(\alpha, R)$ in the captured linear 3-D surface profile map into x, y, z Cartesian coordinates specified as $p(x, y, z)$ in a local Cartesian coordinate system $R_{LDIP/Cartesian}$ symbolically embedded within the LDIP subsystem.

B

STEP 3: At the unitary PLIIM-based object imaging and profiling system, use the PLIIM-based imager employed therein to consecutively capture high-resolution linear 2-D images of the arbitrary 3-D object surface bearing forms of graphical intelligence (e.g. symbol character strings), wherein (i) the x', y' coordinates of each pixel in each said captured high-resolution linear 2-D image is specified in local Cartesian coordinate system $R_{PLIIM/Cartesian}$ symbolically embedded within the PLIIM-based imager, and (ii) the intensity value of the pixel $I(x', y')$ is associated with the x', y' Cartesian coordinates of the image detection element in the linear image detection array at which the pixel is detected, and (iii) wherein also the planar laser illumination beam (PLIB) of the PLIIM-based imager is spaced from the amplitude modulated (AM) laser scanning beam of the LDIP subsystem is about D centimeters.

C

(A)

FIG. 23C1

10091339-071202

(A)

STEP 4: At the unitary PLIIM-based object imaging and profiling system, capture and buffer the camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the corresponding photo-integration time period ΔT_K , by the PLIIM-based imager.

D

STEP 5: At the end of each photo-integration time period ΔT_K , use the unitary PLIIM-based object imaging and profiling system to transmit the following information elements to the Image Processing Computer for data storage and subsequent information processing:

- (1) the converted coordinates x, y, z , of each point in the linear 3-D surface profile map of the arbitrary 3-D object surface captured during photo-integration time period ΔT_K ;
- (2) the measured velocity(ies) of the arbitrary 3-D object surface during photo-integration time period ΔT_K ;
- (3) the x', y' coordinates and intensity value $I(x', y')$ of each pixel in each high-resolution linear 2-D image captured during photo-integration time period ΔT_K and specified in the local Cartesian coordinate system $R_{\text{PLIIM/Cartesian}}$; and
- (4) the captured camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the photo-integration time period ΔT_K

E

STEP 6: At the Image Processing Computer, receive the data elements transmitted from the PLIIM-based profiling and imaging system during Step 5, buffer data elements (1) and (2) in a first FIFO buffer memory structure, and data elements (3) and (4) in a second FIFO buffer memory structure.

F

(B)

FIG. 23C2

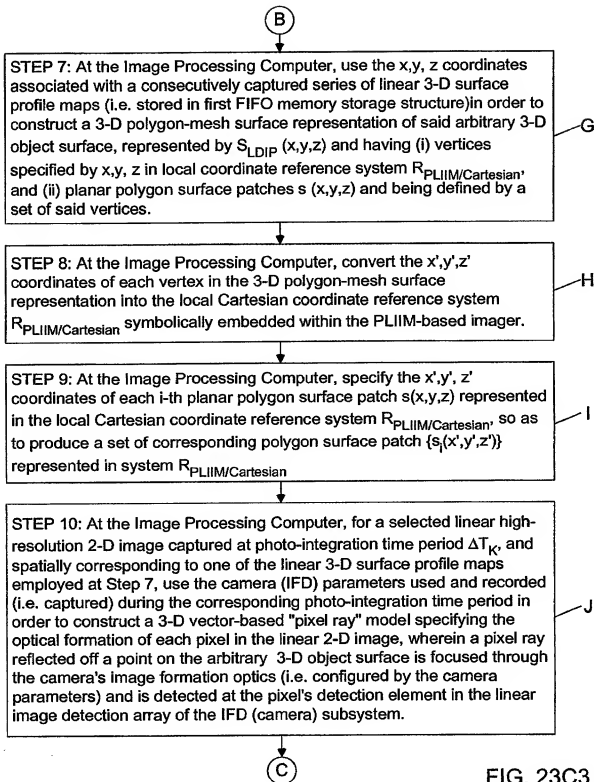


FIG. 23C3

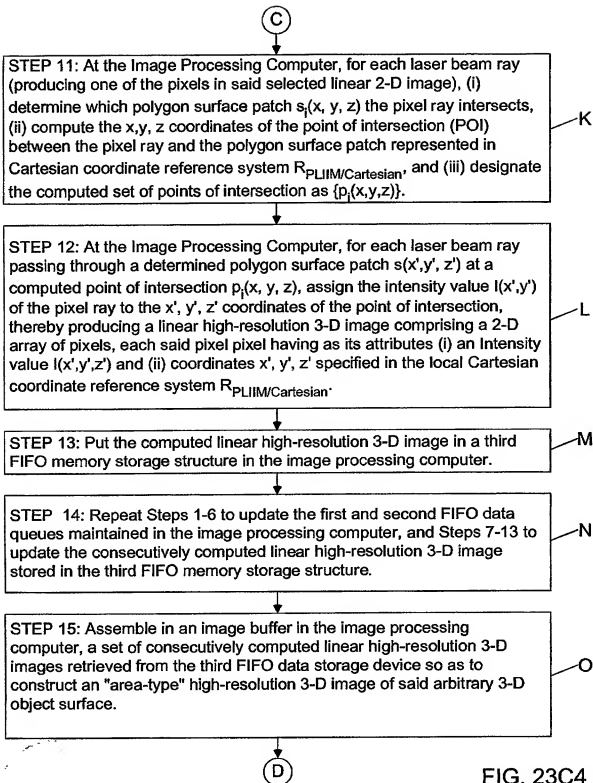


FIG. 23C4

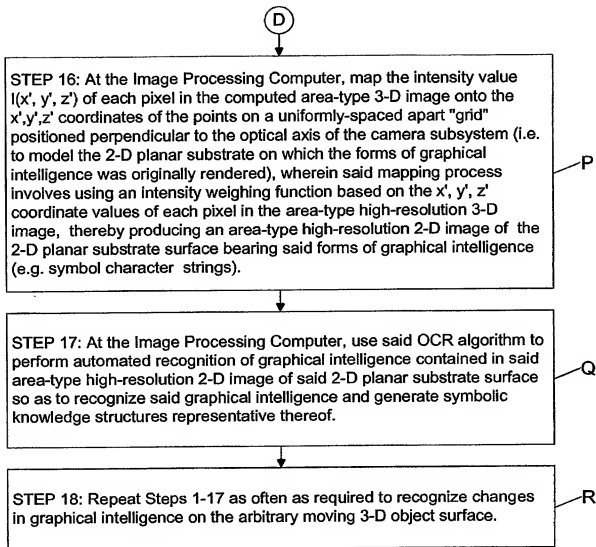


FIG. 23C5

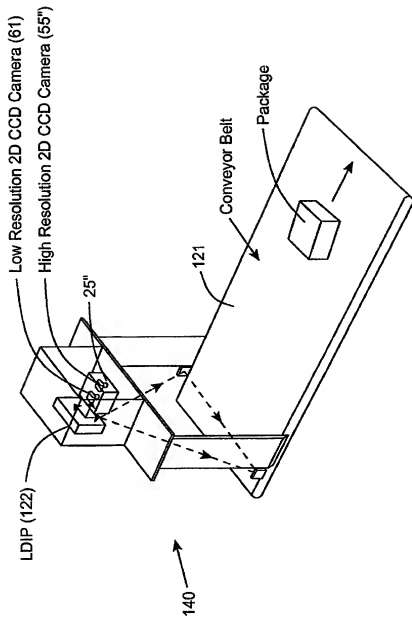


FIG. 24

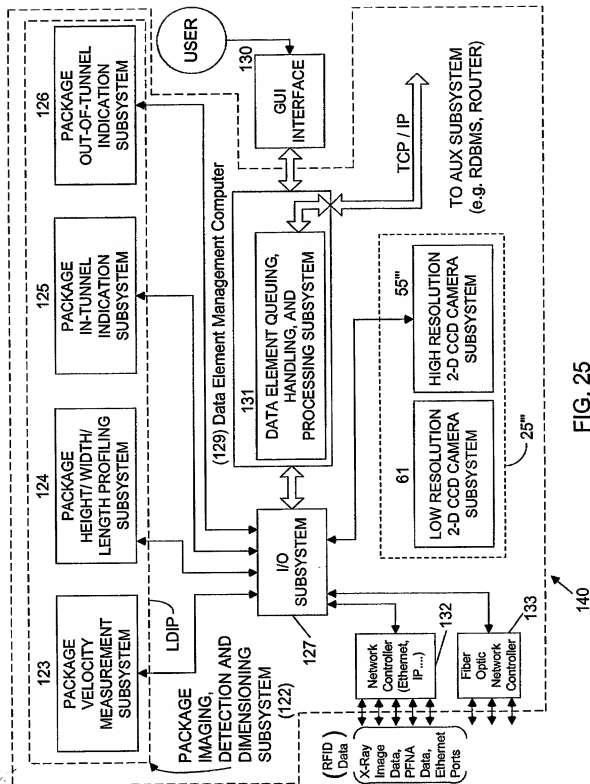


FIG. 25

Data Element Queuing, Handling, and Processing Subsystem (131)

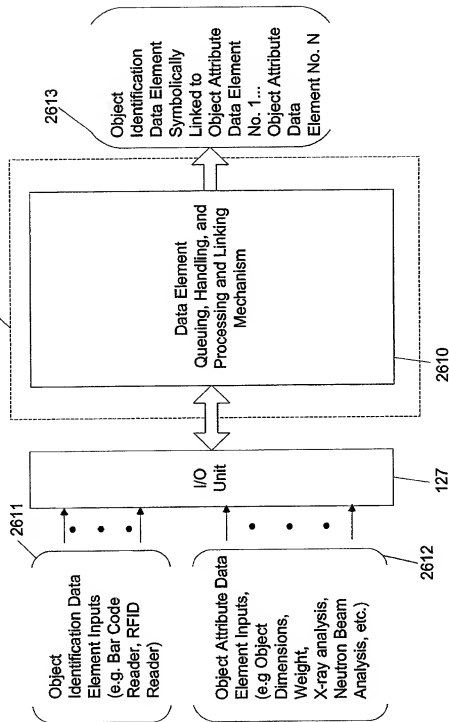


FIG. 25A

Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.

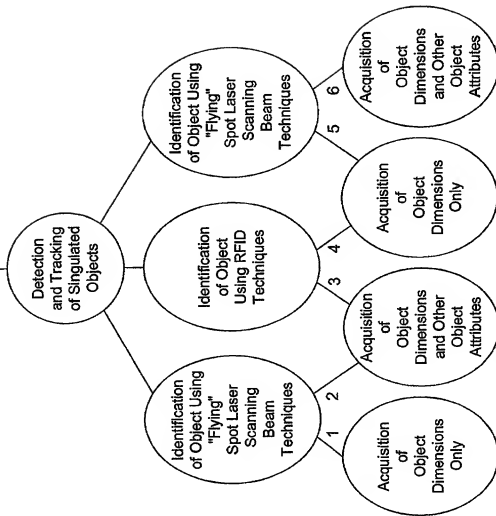


FIG. 25B-1

Primary Network and/ or System Functions:

- A. Specification of Object Detection and Tracking Capability of System
- B. Specification of Object Identification Capability of System
- C. Specification of Object Attribute Acquisition Capability of System

Primary
Network
and/ or
System
Functions:

A.
Specification
of Object
Detection
and Tracking
Capability of
System

B.
Specification
of Object
Identification
Capability of
System

C.
Specification
of Object
Attribute
Acquisition
Capability
of System

Specification of Object Detection, Tracking, and Identification and
Attribute-Acquisition Capabilities of a Configured System or Network.

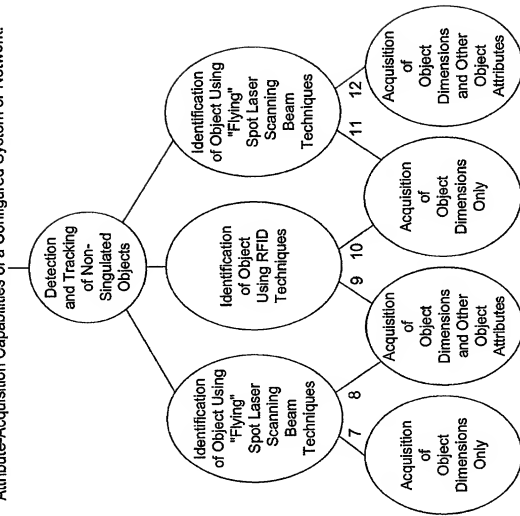


FIG. 25B-2

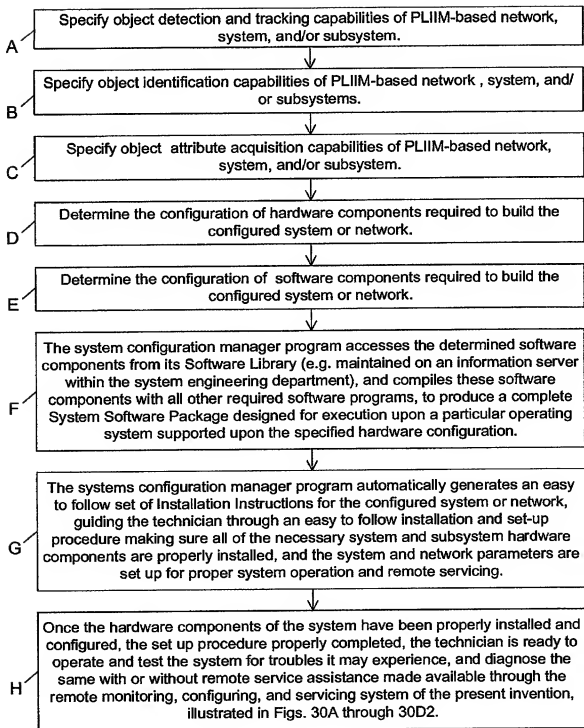


FIG. 25C

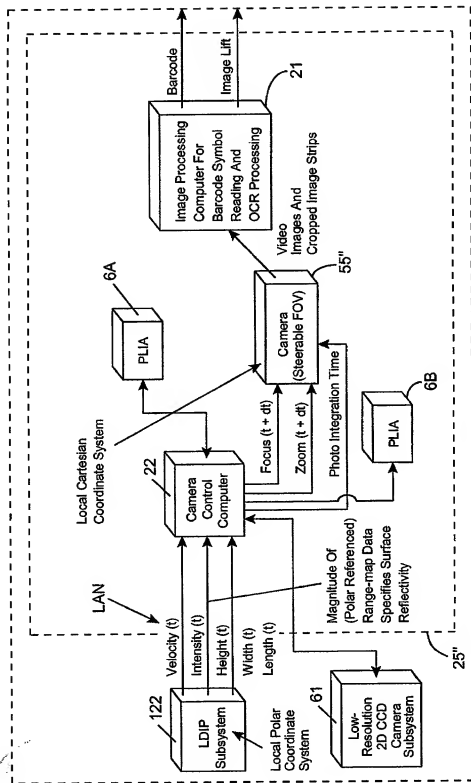
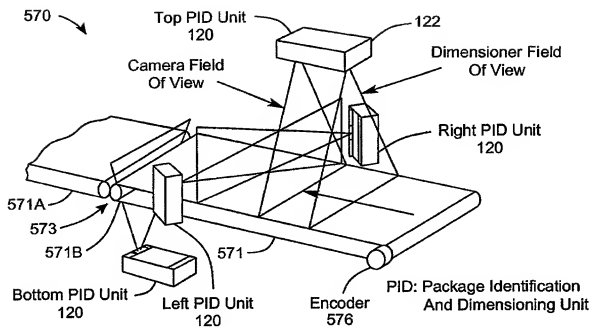


FIG. 26



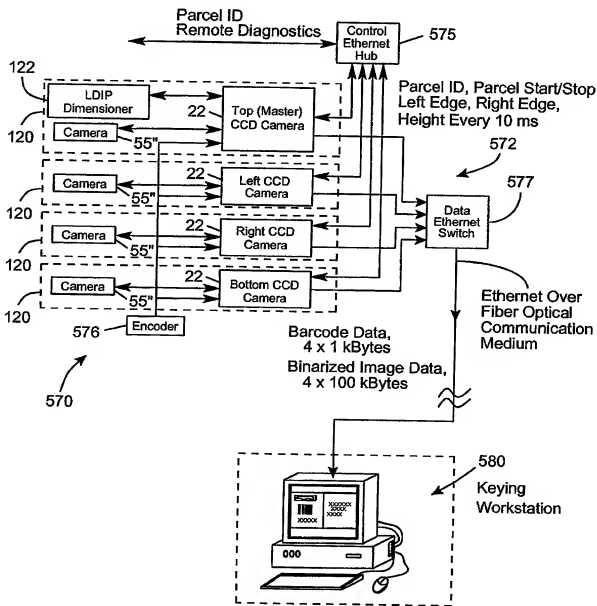


FIG. 29